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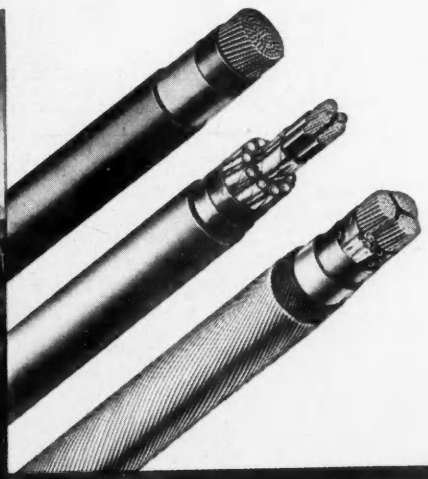

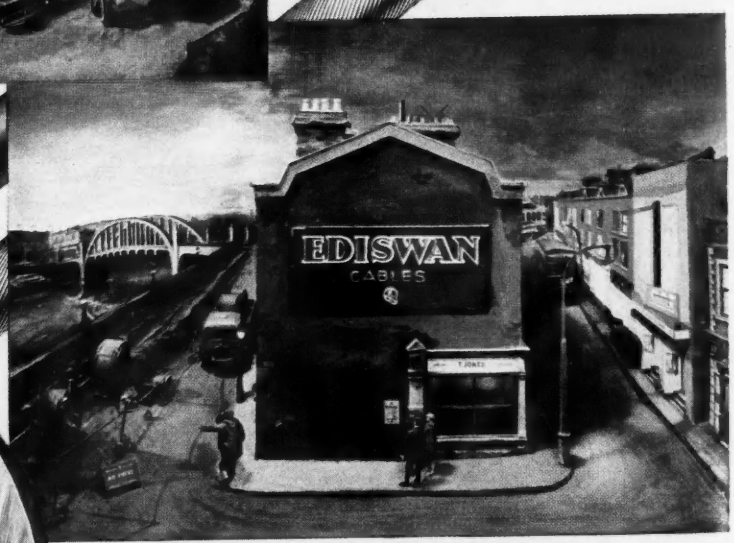

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12 APRIL
1957

ELECTRICAL REVIEW

Managing Editor: HUGH S. POCOCK, M.I.E.E. *General Editor:* J. H. COSENS *Technical Editor:* P. W. TUCKER, M.I.E.E.

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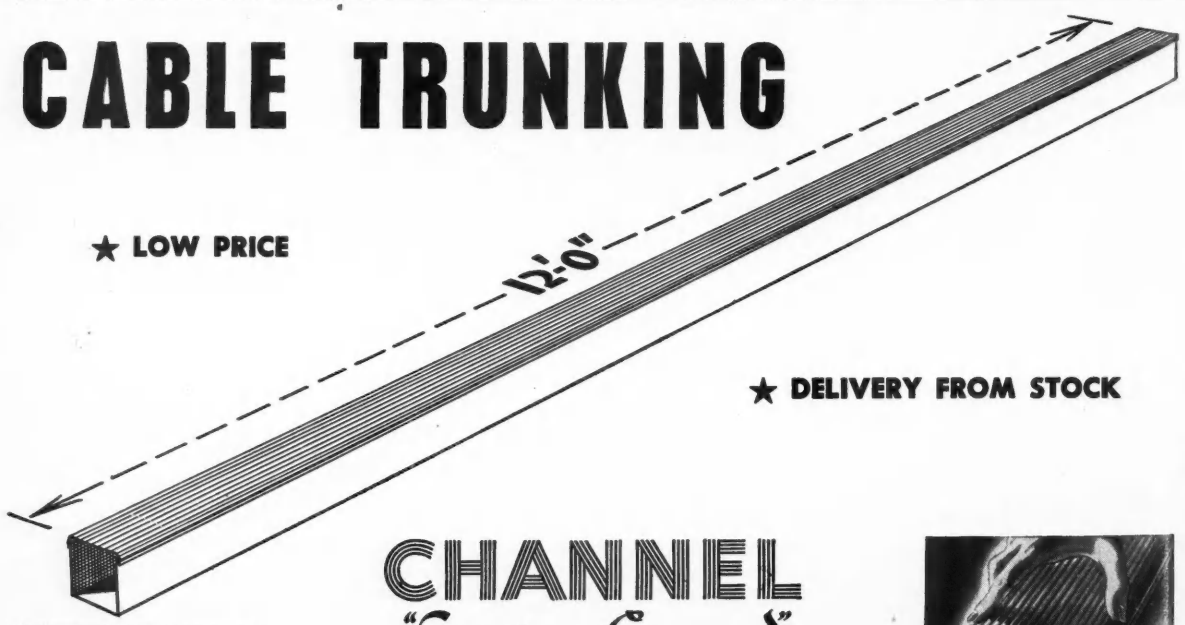

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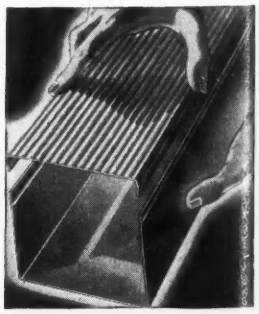

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ELECTRICAL REVIEW

12 April 1957 Vol. 160 No. 15 Established 1872

Outlook for Manufacturers

GUARDED optimism or, as some may think, qualified pessimism seems to pervade the 1956–57 report of the B.E.A.M.A. Council reviewed on page 679 of this issue. This is not to be wondered at when it is remembered how much uncertainty has been engendered in the electrical manufacturing industry by Government action in the last three or four years. The report shows, however, that it was the heavier side of the industry which advanced last year in spite of the shadow cast over it by the Monopolies Commission. Manufacturers of domestic electrical equipment suffered from anti-inflation measures, mainly the hire-purchase restrictions. In the result employment in the entire industry actually fell by about 13,000.

The Council points out that as inflation arises from the failure of production to rise at the same rate as wages, greater efficiency in manufacture is needed to defeat it. One of the principal ways of improving productivity is electrification and the Council claims credit for the electrical industry for its achievement of a generating plant installation record in 1956. Moreover, research and design in the industry is keeping down the kilowatt cost to the 1948 level.

On the export side there was an 11 per cent increase which, the Council claims, raises the electrical manufacturing industry to the position of the country's largest exporting industry. (Exports of the metal-using industries as a whole rose by only 7 per cent, according to the *Economic Survey* 1957, and the country's total exports by 9 per cent.) We still enjoy a greater share of world electrical trade than Western Germany but that country's proportion has risen while ours has fallen. Germany, of course, has had certain advantages some of which may now be disappearing, but her competition has to be studied and countered.

Fears are expressed in the report of the possible effects upon the electrical manufacturing industry of the setting-up of a European Free Trade Area. It is thought that some Continental competitors will start off with some conditions in their favour while we are handicapped in several ways. The industry, it is said, is not afraid of competition but it would be dangerous to admit Continental goods free of duty without prior establishment of satisfactory rules devised to prevent abuses and ensure fair competition.

In the meantime great progress is being made on work which should demonstrate to overseas buyers the ability of British electrical manufacturers to meet their future needs. Particular reference is made to the nuclear power programme, the trans-

atlantic telephone cable and the railway modernisation plan. Opportunities for further expansion are increasing. The *Economic Survey* shows that world trade in manufactured goods continues to rise. All that the industry asks for is freedom from pettifogging interference, based largely on political expediency, and relief from burdensome taxation which sends up costs and prevents manufacturers from making adequate provision for expanding their resources.

ELECTRONIC COMPONENTS EXHIBITION

This week the annual private exhibition of British radio components, organised by the Radio and Electronic Component Manufacturers' Federation, has been held at Grosvenor House and Park Lane House, London. The vigour of the industry concerned is emphasised by this popular exhibition, which, once again, was more comprehensive than the previous year's show. All of the exhibits to be seen at the show were of British manufacture and included components for the radio, television, electronic and telecommunications industries as well as gramophone components, valves, test gear and instruments. The exhibition aroused widespread interest, not only among home buyers but also among many countries overseas.

The British radio and electronic component industry has an outstanding export record and in the past ten years exports have increased over seven times in volume and considerably more in value, the United States last year being the chief buyer, followed by Australia, Canada and India. During the same period the total British production of components increased sixfold to a total last year of 1,500 million items, valued at £81 million. In 1955, 1,400 million components were manufactured with a total value of £74 million.

OPTICAL LOUVRES

The article on "Optical Louvres" by Mr. J. G. Holmes describes a type of prismatic pattern that can be formed on one surface of a clear sheet of glass or plastics material so as to provide a cut-off effect similar to that of cellular louvres, concentrating the light downwards and providing low brightness at normal angles of observation.

In general, a pattern of prisms can be formed on one surface of a thin flat plate of transparent material in such a way that no direct light is transmitted in some particular direction, however the incident light may be distributed. This provides a method of reducing the brightness of a lighting fitting for certain viewing directions, equivalent to the provision of louvres, but without absorption of light. The character of the prismatic pattern is determined by the angular zone in which the cut-off is required, but the contour of the prisms is usually shallow.

In the particular application described in this article, a plate of transparent glass or plastics material is provided with these optical louvre prisms on its lower surface in such a way that it transmits very little direct light in angles between 60 deg and the horizontal plane of the plate. This new optical device reduces the luminance (photometric brightness) and the glare from lighting fittings viewed from angles near the horizontal. Several prismatic patterns have been tried and a pattern of conical prisms has given the best results up to the present, largely because of its power of concealing the shape and position of the lamps.

THE BILL'S PROGRESS

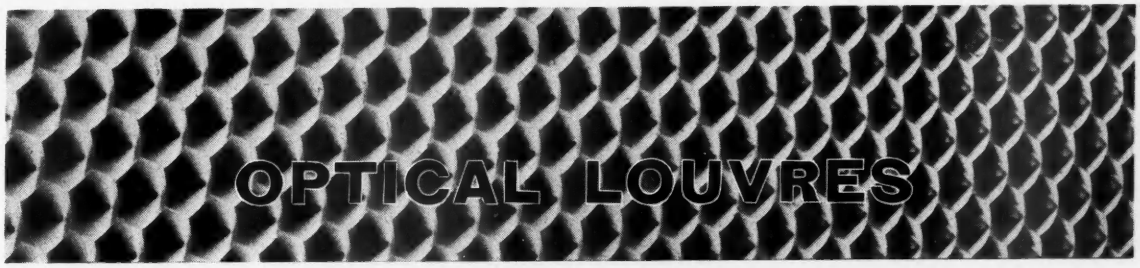
Last Thursday the Electricity Bill received its third reading in the House of Commons and now goes to the Lords. In its passage through the lower House the Bill has been amended in several important respects. Notably the date fixed for the new "vesting day" has been brought forward from 31st March, 1958, to 31st December next. The powers given to the new Generating Board to manufacture plant have been drastically reduced to cover merely the "internal" requirements of the Board. Other amendments will allow the Boards to raise capital on their own account, as well as through the Electricity Council, and in such cases the loans will not carry the Treasury guarantee. Appointments to the new Council and Generating Board are to be made by the Minister of Power soon after the Bill receives the Royal Assent.

POWER STATION EFFICIENCIES

Elsewhere in this issue we publish the annual returns of the foremost power stations of the Central Electricity Authority in terms of thermal efficiency. Once again Littlebrook "B" heads the list, with a thermal efficiency of 30·62 per cent as compared with 30·37 per cent last year. A few years before that Littlebrook held first place with a thermal efficiency of 29·6 per cent and then it gave way to Portobello which had an efficiency of 30·86 per cent. Last year we said that this was readily understood because of the higher steam conditions adopted at Portobello. Second on the list this year, however, is Drakelow with a thermal efficiency of 30·54 per cent and the steam conditions here are, we believe, an improvement on those at Littlebrook. This suggests that in the case of Littlebrook we have to look for the explanation beyond mere steam conditions and we would say that the answer is better loading.

AFTER THE STRIKE

The engineering industry was naturally relieved when the strike was called off after three days but the voting by the unions concerned showed anything but unanimity. This and subsequent events have shown that settlement of the dispute is by no means a foregone conclusion. The Court of Inquiry has investigated the circumstances and will no doubt report immediately. We must not, of course, anticipate its findings but we feel bound to recall that a similar Court was set up in 1954. This Court made a useful survey of conditions in the engineering industry and put forward several recommendations for improving relationships. But seemingly only one, that wages should be increased by about 5 per cent, was adopted. One main conclusion was that some of the issues raised were essentially part of much wider problems affecting the national economy. That remains a fact which makes temporary piecemeal settlements of doubtful value.



New Form of Prism Suitable for Lighting Fittings

By J. G. HOLMES, A.R.C.S., B.Sc., F.Inst.P., A.M.I.E.E.*

In recent years the illuminating engineer has become increasingly conscious of the glare or dazzle from lighting installations, causing discomfort or distraction in seeing. His investigations have shown that the higher illumination levels now used have made glare discomfort more prevalent and that, even in the absence of noticeable discomfort, the strain of avoiding direct or reflected glare may lead to tiredness at the end of the day.

Glare has two main causes: the total amount of light falling on the eyes and the contrast between bright areas and their immediate surroundings. In the particular case of the laylight or a large recessed lighting fitting, glare may be caused by the contrast between the bright fitting and the relatively dark ceiling when viewed from angles near the horizontal. Fluorescent lamps are often employed in such fittings and it has been found that the 70 deg cut-off of the industrial trough gives excessive brightness contrast and insufficient screening for very many installations; it has become general practice to use slats or square louvres to reduce the luminance (photometric brightness) of the light emitted at angles above 50 or 60 deg as well as to hide the lamp from direct view. Louvres, however, are not entirely satisfactory in ways that are now familiar, and the desire to find an alternative prismatic arrangement to achieve a more efficient reduction of luminance at high angles led to the development of the optical louvres described in this article.

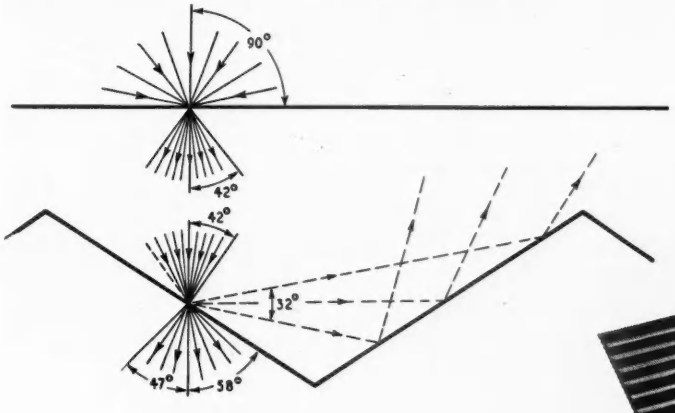
Prismatic Concentration of Diffused Light

It is well known that simple refracting prisms may be used effectively in the form of a moulded glass plate, to concentrate or disperse the light from a relatively small source, that is from a source emitting a coherent radiation. It is also known that no such simple prismatic plate can form a concentrated beam from a relatively large source of light, because of the natural dispersion of the light from the large source incident on the plate. If fully diffused light is incident on a plate of prismatic glass, the transmitted light may be unevenly distributed over the 180 deg hemisphere by the preferential action of the prismatic surface, but in general some light is transmitted in all directions in the hemisphere.

There is, however, a particular design of prism that restricts the emergent light to a cone however the incident light may be distributed. A horizontal plate of these optical louvre prisms has the property that it transmits little or no light within the angles near the horizontal in the so-called " glare zone."

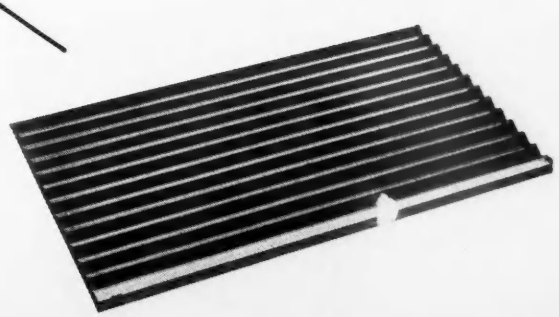
If light which is fully diffused through 180 deg falls on a plane surface of transparent material, such as the upper surface of a glass plate, the light transmitted through the surface into the body of the plate at any point is all contained within a cone whose apex is at the point of incidence and whose angle is determined by the refractive index of the glass. For an index of 1·5, the apex angle is ± 42 deg, derived from the refraction formula which may be written: sin 42 deg$=1/1{\cdot}50$. This light falls on the second, lower, surface of the glass plate and will be partly transmitted and partly reflected. If the second surface is also plane as in plate glass, the light will emerge fully diffused through 180 deg. The design of the optical louvre prism that can be formed on the second surface is such that most of the light from

* Technical Director of Holophane, Ltd.



Left : Fig. 1.—Ray paths through typical cut-off prism

Below : Fig. 2.—Machined " Perspex " plate with linear prisms



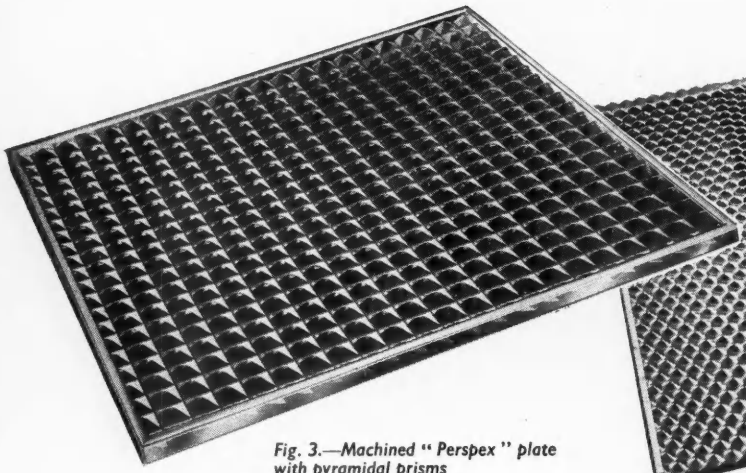


Fig. 3.—Machined "Perspex" plate with pyramidal prisms

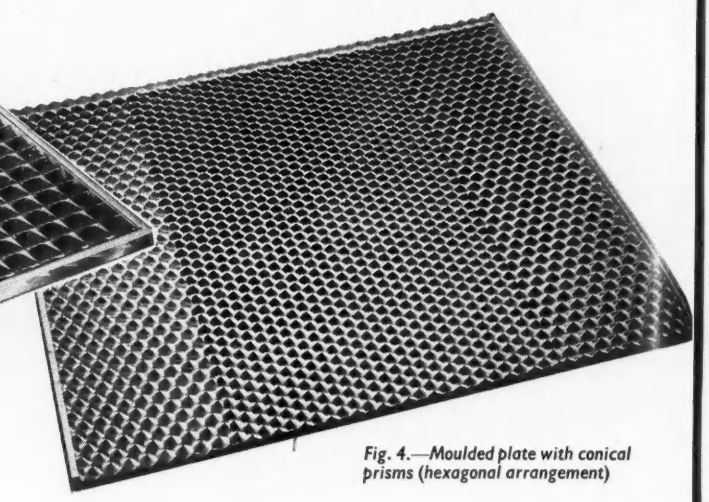


Fig. 4.—Moulded plate with conical prisms (hexagonal arrangement)

the ±42 deg cone is transmitted from the glass to the air in a cone of apex angle ±58 deg, and the rest is totally internally reflected without absorption. If the glass plate were perfectly made, there would be no direct light transmitted at angles more than 58 deg from the vertical, that is at angles less than 32 deg below the horizontal. This selective action of the prisms is illustrated diagrammatically in Fig. 1.

Because the fully diffused (180 deg) light incident on the plane upper surface of the plate is concentrated by normal refraction to a ±42 deg cone within the plate, the light rays reaching any point on the lower prismatic plate surface are contained within a cone of the same angle; most of these rays are directly transmitted as indicated by the solid lines in Fig. 1, but some are internally reflected as indicated by the broken lines. If the angle of the prismatic surface is suitably chosen the transmitted light will be restricted to an angle less than that of the valley between the prisms, so that the louvre effect is entirely optical and does not include any mechanical screening by the projecting prisms. Moreover, the light internally reflected is symmetrically reflected at the second face of the prism, so that it does not emerge at a higher angle than the directly transmitted light. This reflected light is returned to the top surface of the plate from which it is mostly reflected at a suitable angle for transmission through an adjacent prism. It follows that some of the rays may traverse a considerable distance within the body of the plate and that the material of the plate must be of low absorption factor and quite clear and non-diffusing in character, so that the controlling effect of refraction is unimpaired by random scatter of the light.

It may be shown* that the best angle of the prismatic surface is given by the formula:

$$P = 60 \text{ deg} - 2.C/3$$

where P is the angle of the prism and C is the critical angle of refraction, obtained from the refraction formula:

$$\text{Refractive index} \times \sin C = 1.$$

For a refractive index of 1·5, the value of C is 42 deg and the value of P is 32 deg. The value of 32 deg is important, because the desired effect can only be obtained within a narrow range of prism angles. In this matter, as in many others, the prism must be correct if it is to give the right result. The angles of the limiting rays are as shown in Fig. 1.

* British Patents 619084, 718504.

In this section is has been shown that fully diffused light incident on the upper surface of a particular design of prismatic plate is transmitted within a cone of ±58 deg angle, so that for a horizontal plate there is no direct light transmitted towards angles of view within 32 deg of the horizontal.

Design of the Prismatic Pattern

Fig. 1 is the basic cross-sectional design of the cut-off prisms. This may be developed into three dimensions as a pattern of linear prisms (Fig. 2), a pattern of pyramids (Fig. 3) or a pattern of cones (Fig. 4). The same optical principles apply throughout, although the optical calculations of skew rays for the three-dimensional case are too complex for this article. The optical effects are not dependent on the arrangement of the prisms, so that the

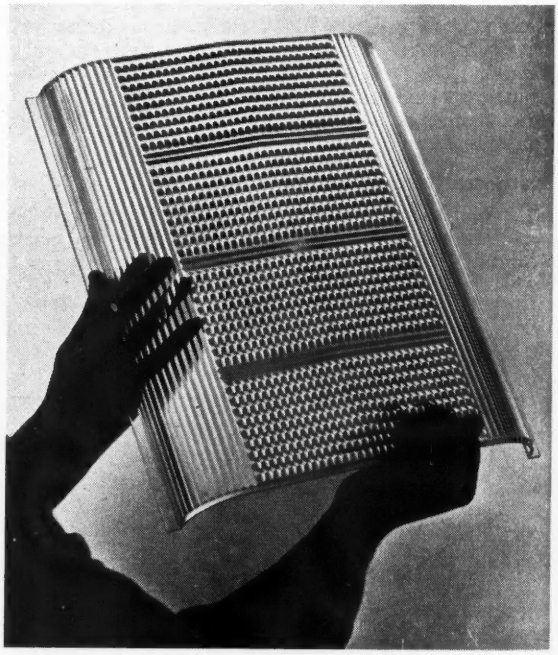


Fig. 5.—Moulded plate with conical prisms (rectangular arrangement) and linear prisms

"texture" of the plate can be designed to give an interesting pattern as illustrated in Figs. 4 and 5.

The principle of a plain upper surface and a prismatic lower surface is fundamental in the mathematical analysis because this is the only way of ensuring a coherent light distribution within the body of the plate. In practice, however, the upper surface need not be truly flat, but may be given a shallow curve or a pattern of shallow flutes without significantly affecting the cut-off effect of the prisms.

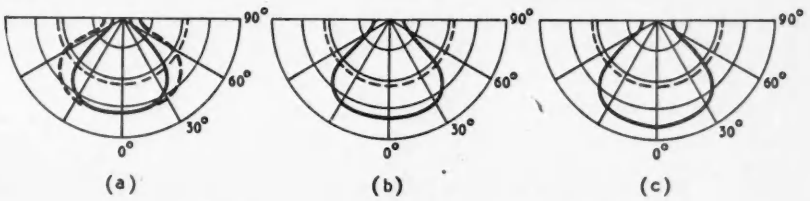


Fig. 6.—Polar curves of luminance (photometric brightness)

(a) Linear prisms. (b) Pyramid prisms. (c) Conical prisms.

Photometric Properties

The optical properties of a perfectly made plate are directly calculable but no practical plate is perfectly made; the corners are not sharp and the various faces are not optically true. It is therefore of interest to record the results of photometric measurements made on typical manufactured plates with fully diffused light incident on the upper surface. Fig. 6 shows how the luminance (photometric brightness) of the surface of several cut-off prismatic plates varies with the angle of observation. In each diagram, the broken line represents a perfectly diffusing transmitter, such as idealised opal glass, having the same light output as the prismatic plate. It will be seen that for each pattern there is a concentration of light in the downward direction, giving over one-and-a-half times the relative intensity of a perfectly diffusing transmitter, whilst the luminance of the prismatic plate is less than that of the perfect diffuser at all angles within about 45 deg from the horizontal.

Although the prisms are precise and regular, rather than diffusing in the sense of figured rolled glass or fluted "Perspex," they can have valuable obscuring properties. The linear prisms shown in Fig. 2 do not hide the blue coloration at the ends of tubular fluorescent lamps, but the conical cut-off prisms shown in Fig. 4 have been found to provide complete masking of the electrodes and lamp-holders of lamps mounted about 2½ to 3in above the plates. The light from two fluorescent tubes 6in apart can be so mixed that they are almost indistinguishable at normal angles of view if mounted about 3in above the plates. These obscuring properties are only incidental to the photometric control of luminance, but they are nevertheless very useful in designing a lighting fitting.

Applications

The first applications of the cut-off prism system have been in large-area lighting fittings with fluorescent tubular lamps, in which the light source is too large for the rays of light to be properly controlled by prismatic refractor plates of more traditional design. The cut-off prisms are most effective when the incident light is fully diffused and they are therefore very suitable for naturally-lit or artificially-lit laylights. They are of particular value in installations comprising continuous lines of fittings, in which serious glare can occur if the luminance distribution is not properly controlled.

Although the first designs employed linear prisms, it was found that the obscuring power of conical prisms was of great value and superior to the other prismatic shapes, projecting or re-entrant, which can be developed from linear prisms.

The cut-off prism, and particularly the conical prism, is the expression of a new idea in controlling the light from extended sources, and while its advantages in multi-lamp fluorescent fittings are obvious, it is still too early to see its whole field of application. It is likely to give a particular, invariable, distribution of transmitted light, independent of the size and shape or position of the actual source of light, and it is a matter of research to find the best way of using this property.

Waterworks Pump Drives

IN a paper on "Modern Trends in Waterworks Pumping Machinery," which was read before the Institution of Mechanical Engineers on 5th April, Mr. T. Irvine Hudson said that although the development of the steam engine, coupled to the reciprocating pump, had continued well into the 20th century, owing to its great flexibility, high efficiency and reliability, its high capital cost, fuel and labour charges had ruled it out for new installations. In fact, the displacement system by suction gas and paraffin engines had begun towards the end of the 19th century, while between 1918 and 1930 the lower cost of the centrifugal pump and improvements in its design had virtually eliminated the reciprocating pump from major installations. To increase flexibility the heavy oil engines drove direct-current generators.

By the end of the 1939-45 war most pumping stations were working to capacity and much reconstruction was overdue. There was also an increasing demand for water and the keynotes of the new plant had to be simplicity, compactness and economy in labour, combined with the highest efficiency, flexibility and reliability at the most economic overall cost. Electrically driven centrifugal pumps, supplied from the public mains, with heavy oil engine driven alternators to provide 100 per cent standby, were much favoured to meet these conditions.

The centrifugal pumps initially developed for wells and boreholes had a shaft inside the rising main which was connected to a drive on a surface head stool. During the past 20 years, however, the submerged motor had been increasingly used for limited applications, although considerable progress had been made with both types to produce larger sizes and to improve efficiencies, which had been increased to 80 per cent for the shaft type and 70 per cent for the submersible type. To reduce the heavy starting currents 3·3 kV motors had also been developed for both types, polyvinyl chloride being used for insulation and the interior of the motor being filled with water to cool the windings and lubricate the bearings. The main limitation of the submersible pump was the squirrel-cage motor with its constant speed which intro-

duced difficulties in the control of output. Nevertheless, where the water level and rate of extraction were constant it was increasingly displacing the shaft-driven type.

Surface Pump Design

In the case of surface pumps the designer was free to obtain the best combination of impeller diameter, number of stages and speed to obtain the highest efficiency for any given range of duty. Generally, the split-casing type had been used for low and medium heads and the cellular-turbine type in the higher ranges. Higher heads could now be employed with the former, the principal advantages of which were the ease with which the impeller could be withdrawn without disturbing the pipe connections and the greater efficiency. Where speed control was required over a wide range d.c. motors were employed, these being fed from the public supply through rectifiers rather than from independent plant.

Provision for surge control equipment was in many cases a necessary adjunct to modern pumping plant and automatic control could be installed to start and stop the pumps within a predetermined range of head pressure, rate of flow, reservoir level or time, the necessary equipment being installed in an unattended station or in a fully manned station some distance away.

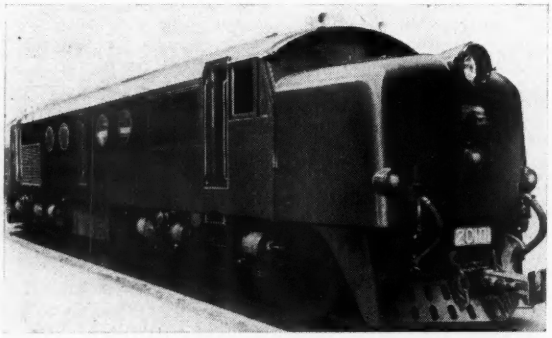
The majority of pumps in waterworks to-day were of the centrifugal type and were directly driven by a.c. motors taking power from the mains. The most popular motor was of the s.c. type, which was a fixed-phase-speed machine; and this often imposed a severe handicap on the pump designer, especially as, where the friction head was a high proportion of the total head, the percentage speed variation might be high. The employment of s.r. motors with rotor resistances or commutator motors, which gave a speed range up to 15 per cent above and below synchronous speed, did not provide a complete answer. In fact, for wide and efficient speed variation there appeared to be no satisfactory alternative to direct current. Rectification was then the chief problem as this involved expensive apparatus and a further loss of efficiency. The average level of performance of motor-driven centrifugal pumps was probably lower than 80 per cent and as a result there appeared to be a need in the waterworks field for a notable development in the design of alternating-current motors to produce what might be described as a variable-speed squirrel-cage type without undue complication and relatively high cost. Such a development would lead to the introduction of units operating over a wide range of duty at a high level of efficiency throughout the range and to a greater measure of standardisation, and would reduce to the minimum the number of "tailor-made" "on-off" installations.

Diesel-Electric Locomotives for Malaya

AN order was placed with the English Electric Co., Ltd., in August, 1955, for a first batch of 1,500 h.p. Co-Co main line diesel-electric locomotives for the Malayan Railway, and the first of these locomotives was officially inspected and handed over at the company's Preston Works on 27th March. They are intended mainly for operation on the line from Singapore through Kuala Lumpur to Prai. Parts of the main line track present difficult operating problems, particularly the Taiping Pass between Kuala Lumpur and Prai which is subjected to very heavy rainfall and at the same time has many sharp curves combined with gradients of 1 in 80.

The locomotive superstructure is carried on two three-axle bogies. Each axle carries a nose-suspended traction motor driving the road wheels through single reduction spur gearing. The floor plate of the underframe is unbroken throughout its length to eliminate the possibility of dirt from the track entering into the equipment compartments.

The two driving cabs extend over the full width of the locomotive, with the driving position arranged at one side of each cab, permitting the locomotive to be driven in either direction. Streamlined nose compartments in front of the driving cabs contain the traction motor blowers and exhausters.



Main line diesel-electric locomotive for the Malayan Railway manufactured by the English Electric Co., Ltd.

The diesel engine is a twelve-cylinder version of the "SVT" English Electric range, developing 1,500 h.p. at 850 r.p.m. The "SVT" range is manufactured with 8, 12 and 16 cylinders arranged in two banks in "vee" form at an included angle of 45 deg, having a bore and stroke of 10in and 12in respectively. It is exhaust gas turbo charged by means of two Napier chargers mounted on the engine above the main generator.

The engine operates on the four-stroke cycle with solid fuel injection and is directly coupled to the main generator. It is of monobloc construction with renewable wet-type cylinder liners, the separate cylinder heads being bolted to the crankcase casting.

The main generator is a 1,000 kW self-ventilated separately excited machine with an additional series field used only when motoring the generator to start the engine. The six 195 h.p. traction motors, which are permanently connected in three parallel groups of two in series, are series wound, six-pole machines which are force ventilated from two motor blower sets. A 60 kW auxiliary generator is overhung from the main generator and, in addition to providing excitation current for the latter, supplies the motor-driven auxiliary machines, battery charging, control and lighting.

The output of the main generator is automatically controlled to coincide with the available horse-power at any one engine speed by means of a load regulator contained in the main generator field circuit. The regulator is actuated by the servo-mechanism of the engine governor. Continuously variable engine speed is obtained by variation of the air pressure to the governor control mechanism, the variation of air pressure being obtained by a regulating valve mounted in the bottom of the controller and actuated by the driver's control handle.

The Homogeneous Aqueous Reactor

ITS USE FOR POWER GENERATION DISCUSSED

THE development of the homogeneous reactor in which the fissile and fertile materials are used as solutions or suspensions in light and heavy water was reviewed by Messrs. R. Hurst, L. Wells and D. Newby in a paper which they read before the Institution of Chemical Engineers on 2nd April.

In many respects this type of reactor had substantial advantages over others for a national power system. The costs per kWh and per kW were small, the fissile material inventory was very low and the two-zone breeder reactor was expected to consume fertile material only, thus conserving the world supply of fissile material. Moreover, the reactor was inherently safe from the nuclear point of view, although considerable work was necessary to make it satisfactory mechanically at a low cost. The doubtful factors were corrosion and the life of the main circulating pumps.

Present Limitations

The first homogeneous reactor, or "water-boiler" as it was now called, was produced in Paris in 1939 and when France was overrun a year later work was continued at Cambridge. Further progress was made at Los Alamos in 1943 and other reactors had since been built both in the United States and at Harwell. All these "water-boilers" had been limited to operation at a power level of about 50 kW and a temperature below 100 deg C. If, however, an aqueous system were to be used for the generation of heat at a temperature suitable for operating a heat engine the working pressure must be high, so that thick pressure vessels and special valves, pumps and joints were necessary. Moreover, the high temperature led to an increase in the rate of corrosion and the higher rate of working increased the effects of radiation flux. Fission products would accumulate and the system must therefore be completely leakproof.

Subsequent investigations at the Oak Ridge National Laboratory had demonstrated the basic feasibility of the fluid-fuel concept. The problems of the continuous chemical removal of the fission products from the core, and the effects of radiation on corrosion and on the stability of the solution were now being examined and the various components were being tested. A power breeder reactor, of which a detailed description was given, had also been installed at Harwell. In this equipment uranyl sulphate was pumped from the core container through nine circuits, each of which contained a straight-through single-pass natural circulation evaporator capable of generating saturated steam at 350 lb/sq in. The slurry was passed through three evaporators which generated steam at the same pressure and was subsequently pumped back to the blanket vessel. A fraction of the main core circulation was by-passed through a gas-handling circuit where its pressure was reduced from 1,800 to 880 lb/sq in. This produced a fluid mixture of about two parts gas and one part liquid by volume from which the gas was separated and finally returned to the main core circuit.

The power reactor system generated its own fuel and was dependent only on the supply of make-up thoria for the blanket. To maintain its independence a single pressure saturated steam cycle was envisaged. Bled-steam feed heating would be used, together with an inter-stage moisture separator, operating at about 30 lb/sq in absolute, to reduce the wetness of the steam in the low-pressure stages. Saturated-steam turbines for operating on a cycle of this type were being developed and overall thermal efficiencies of 25 per cent were expected.

In considering the use of homogeneous aqueous reactors on a national scale it had to be remembered that uranium 233 was not likely to be available in the quantities required. A convector reactor would, however, use uranium 235 or plutonium 239 in the core, together with a thoria blanket, and would produce power at about the same cost as the breeder system, depending on the relative cost of the three fissile materials. The uranium 233 formed in the blanket would then be available for other reactors and the homogeneous aqueous reactor might be the most favourable means of making this conversion. It was possible to dispense with a blanket and to run a much simplified version of the core circuit above as a burner-reactor for the generation of small amounts of electricity. The fuel would be either uranium 235 or plutonium and there would be no conversion of fertile material. The chemical processing and gas-handling circuits could be eliminated and the problem of developing a corrosion-resistant core vessel transparent to neutrons did not arise.

There was also a possibility of using a suspension of mixed uranium and thorium oxides in a single-zone reactor. This would have the advantages that there would be no need for a neutron-transparent corrosion-resistant core vessel, nor for a chemical plant to process uranium 233. There would, however, be a loss in conversion factor, increased resonance absorption and higher neutron leakage.

The single-zone breeder reactor appeared worthy of further detailed examination and work on it was being done in the United States and the Netherlands as well as possibly also in Russia.

DISCUSSION

The chairman, Mr. A. S. White, said that so far as power stations were concerned, it had already been said that much higher rated reactors were wanted. The homogeneous aqueous reactor met this requirement.

Mr. R. G. Tongue recalled that an O.E.E.C. study group was to make proposals within two months on the setting up of a joint establishment for building a homogeneous aqueous reactor and the chairman of the United States Atomic Energy Commission had proposed the construction in the U.S.A. by 1962 of a homogeneous aqueous reactor of 100 MW rating. He hoped that the requirements for the reactor would be lower capital investment per kW; the production of cheaper power; a feed of about 3 lb of thorium in the form of thoria powder per MW year; and that these would be pursued as vigorously in the United Kingdom as elsewhere.

It was interesting to see how the authors had placed emphasis on regarding the processing plants as essential parts of the complete reactor scheme. Dr. J. V. Dunworth had shown that in the case of the fast breeder reactor the whole of the large breeding gain could be lost if the recovery efficiency in the processing plant was only 95 per cent.

The processing plants which might be associated with future homogeneous aqueous breeder or convertor

reactors promised to be simpler than those serving Calder Hall types; for example, neither fissile nor fertile materials appeared as metals, nor were cans used. Thus processes involving low β and γ decontamination factors became more easily economic. Mr. Tongue asked for confirmation that, as a result, the minimum economic size of processing plants to serve homogeneous aqueous reactor power stations would be significantly smaller than that for Calder Hall type stations.

In reply to Mr. Tongue, Dr. Hurst said that their aim was a technical one. The element of metallic fuel fabrication and processing and reprocessing in the metallic type of reactor, allied with the slow burn-ups, indicated that the aqueous system should yield a benefit on fuel costs. It was hoped that the simplicity of the mechanical plant would lead to a low capital cost, but some of this advantage might be cancelled out by containment needs and remote handling procedure for pumps. He considered that American figures which had been given were not always realistic. The system was probably 10-15 years ahead, but the authors believed that in the long run it would mean extremely cheap power. Large-scale plants had distinct advantages in processing, and the authors thought in terms of five reactors on one site, with their own chemical plant.

The corrosion rate for stainless steel was 0·0001in a year; for a number of other metals the rate was almost unmeasurable. For the external plant, corrosion was not a difficulty, except where high velocities were encountered, in which cases it would probably be necessary to use titanium. He had not seen evidence of stress contamination due to sulphate. However, under the effect of radiation a new factor seemed to enter into the question of corrosion, particularly with zirconium and also, to a lesser degree, with steel and titanium. The cause was not known, although they had an empirical idea of how it varied with the power density. Further information waited on work on high flux reactors; the rather difficult and lengthy experiments would take about a year. The assumed life of the core vessel material was 5 to 10 years.

A reduction of the temperature by 75 deg C would have an effect on corrosion, but it would mean a loss of several MW of the general heating. A number of other possibilities for overcoming corrosion included coating with a material which did not show this effect, or having a " tailor-made " oxide. Dr. Hurst believed that in two to three years the answer to this problem would be found.

Steam Superheating

Mr. G. C. Allingham asked whether it might not be an advantage to superheat the steam. It had been pointed out that by superheating the steam, the thermal efficiency could be raised by 4 per cent—a very considerable increase. In one of the fast reactors in the United States, supplying an actual power system, an electrically operated immersion superheater was employed. An oil-fired superheater had also been suggested. Mr. Allingham thought that it might be a sensible idea to take, say, one per cent of the output of the power station to superheat the steam.

The authors spoke about being able to do something in 10 or 15 years, but Mr. Allingham was more hopeful. He pointed out that the design studies for Calder Hall were published in 1951—and five years later the station was supplying power to the grid. He appreciated that a great deal more had to be known about homogeneous aqueous reactors, but on the other hand a great deal more was already known than in 1951 about nuclear physics and chemistry generally.

Mr. D. Newby said that the fuel costs in the homogeneous system were a very minor part of the power costs, and unless it was possible to have a method of superheating by a very cheap fuel (costing less than 5d per therm), it was not economic to do this. To use one's own electricity for the purpose would be much more expensive, and if oil or coal were employed, the station would become dependent on outside supplies for the reactor, and so there was the need of transport.

Mr. R. C. O. James wondered if the corrosion of zirconium had any typical appearance which differentiated it from other types of corrosion. Speaking with the cynicism of a plant engineer, he was depressed by the number of circulating loops in the whole system. There would be difficulty in maintaining each one in a state of efficiency.

In further replies Dr. Hurst pointed out that the Calder Hall design was directed straight to the large-scale prototype. It was felt that the development of the aqueous homogeneous reactor should proceed in two stages—first a small reactor experiment and then a large-scale prototype. So far as he was aware the corrosion was general and not pitted.

Automatic Control

AN exhibition of automatic control equipment was held in the Applied Science Faculty of the University of Nottingham recently. The main section of the exhibition was a display of automatic control equipment, arranged in connection with a course which had been held in the University during the winter months for local works and plant engineers. Among items of particular interest were some exhibits by Boots Pure Drug Co., Ltd., including a viscosity timing meter using the principle of the unbalanced inductive bridge. They also demonstrated the use of an electronic controller to keep the temperature of a vessel of water constant by varying the gas supply to a Bunsen burner heating the water. Elcontrol, Ltd., showed a variety of instruments which included a photo-electric smoke meter and alarm, and Evershed & Vignoles, Ltd., exhibited modern methods of plant control which utilise the balanced arm electronic computer.

The mobile demonstration unit of Fielden Electronics, Ltd., included a precision temperature controller and a continuous micrometer. Another item of interest was an electronic colour sorting equipment exhibited by Lancashire Dynamo Electronic Products, Ltd. W. H. Sanders, Ltd., showed a spot welding ignitron controller.

The main part of the exhibition was organised, under the guidance of Professor J. E. Parton, by Mr. J. V. Parry, a lecturer in the Department of Electrical Engineering. The second part was held in the Automatic Control Laboratory and consisted of experiments illustrating the fundamentals of automatic control. Finally, a selection of books was arranged by the Engineering Library.

The whole exhibition was organised by the committee of the course under the chairmanship of Mr. E. G. Phillips and the Dean of the Faculty of Applied Science, Professor J. A. Pope.

Birmingham Tube Plan

BIRMINGHAM City Council is being asked this week to give further consideration to a £13,500,000 plan for the city's first underground railway.

A joint conference of various committees, set up three years ago, had reported to the General Purposes Committee that it did not consider that the plan should be proceeded with but in a report issued last week the General Purposes Committee expressed the view that the scheme should be further examined.

The plan envisages a 14-mile route from one side of the city, becoming an underground system beneath the city centre.

A REVIEW OF THE R.E.C.M.F. EXHIBITION

Radio and Electronic Components

THE number of exhibitors at the fourteenth British Radio Components Exhibition held this week at Grosvenor House and Park Lane House, London, once again broke the previous record with a total of 163. No doubt this was due in some measure to the vigorous development now being carried out in the field of automatic control. All the exhibits were of British manufacture and included components for the radio, television, electronic and telecommunication industries, as well as gramophone components, valves, test gear and instruments. The exhibition was organised by the Radio and Electronic Component Manufacturers' Federation.

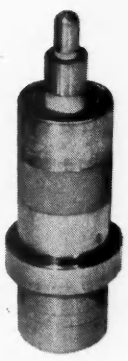
A new range of valves for car radio sets which operate with a 12 V h.t. line directly off the car battery was exhibited by Standard Telephones & Cables, Ltd. They also showed a new addition to the " Trustworthy " range; it is a high slope r.f. power amplifier valve, which is also useful for video amplification. The company's exhibits also included a range of transmitting valves, gas-filled relays and high power rectifiers (mercury vapour and vacuum types). An interesting item among their exhibits was the new " Brimar " 21in teletube with a 90 deg deflection angle, which was shown for the first time. The exhibits of Ferranti, Ltd., included valves and cathode-ray tubes for sound and television broadcast and industrial applications. Their ceramic valves are designed to withstand severe shock and high ambient temperatures; the UL.11 is an r.f. oscillator amplifier with an output of 1,000 Mc/s c.w. or 2,000 Mc/s pulse operation.

The exhibits of the General Electric Co., Ltd., included representative types of thermionic valves, i.e. industrial heating valves, gas-filled rectifiers, hydrogen thyratrons, magnetrons, audio valves and special receiving valves. Three new industrial heating valves, the ACT.100, ACT.101 and ACT.102, were shown, the main features of these types being their robust construction and long life expectation. Other exhibits included transistors for various audio-amplifier and switching applications and a germanium junction medium-power diode which can be supplied in numerous combinations of series, parallel, or series-parallel stacks to provide various output voltages and currents. The 7in rectangular viewfinder tube for TV cameras, introduced by Mullard, Ltd., offers an important advantage in space economy over the 5in circular types. Other new developments by this company on view were the high brightness radar tube which has been developed for conditions of very high ambient light and picture tubes with electrostatic focusing and 90 deg magnetic deflection. Among the examples of semi-conductor devices exhibited were the two new 100 V subminiature diodes, both of all-glass construction and intended primarily for industrial application. Newcomers to the Mullard transistor range were included in their wide selection of products, the OC44 designed for use in convertor and mixer oscillator circuits, and the OC45 intended for use as an i.f. amplifier in amplitude modulation receivers.

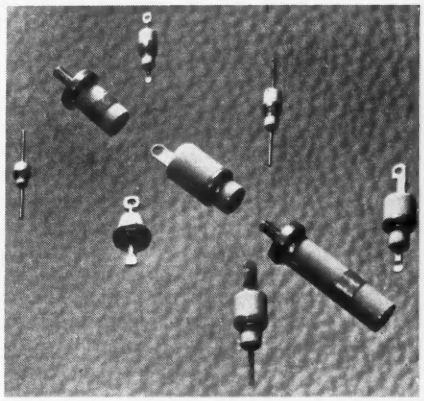
Cables and Insulators

The latest trend in plastic insulation was shown by British Insulated Callender's Cables, Ltd. The exhibits displayed included a comprehensive range of miniature multi-core cables and cables for use at both audio and radio frequencies. The television relay cables are precision screened and quad cables with very low cross-torque couplings. These are intended for the distribution of two vision channels having the same carrier frequency and of two power audio channels. Also on show on this stand was a representative selection of winding wires. This included wires with oil-based insulation, with synthetic enamel types " Bicalex " and " Fifty-three," the self-bonding " Bicaloc " type, heat-resisting silicone-enamelled wires, self-fluxing " Bicelflux " and silk- and rayon-covered wires. A comprehensive range of Telcon cables and connectors were exhibited and of particular interest were the helical membrane cable for television and radio transmission, cellular polythene television down leads and multi-way cables (miniature aircraft pattern) manufactured to Government specification.

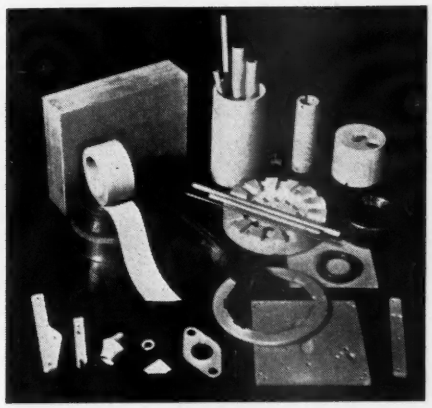
A wide range of insulating materials was on display by the Micanite & Insulators Co., Ltd., who also showed silicone insulation, including laminated glass sheets, micanite tubes, and glass mica tape. Alongside these



Ferranti ceramic valve



Group of metallised terminal bushes manufactured by Steatite & Porcelain Products, Ltd.

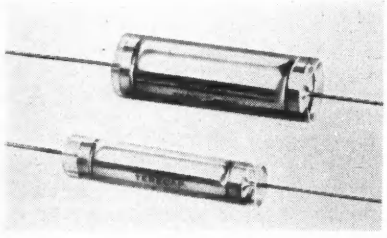


Selection of silicone insulation manufactured by the Micanite & Insulators Co., Ltd.

materials a range of "Paxolin" synthetic resin bonded laminates was shown together with mouldings in p.v.c. and other thermo-plastics. Resins which are claimed to have revolutionised design as well as production methods were shown on the stand of Aero Research, Ltd. The company's "Araldit" casting resins, which are suited for encapsulation and sealing of components and circuits, were shown. The adhesive forms of this resin find many uses in the electrical industry for bonding metals, porcelain, glass, rubber and various plastics.

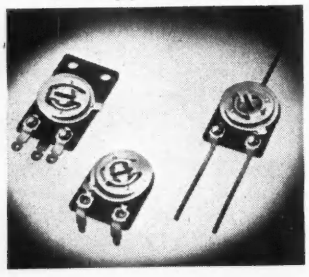
The many applications of mica as an electrical insulator were illustrated in the display of Langley, London, Ltd. Their products included a wide variety of mica and fabricated laminate plastics in many shapes and forms. Among the many insulators manufactured by Steatite & Porcelain Products, Ltd., were aerial insulators, valve electrode supports, insulating beads and washers and power system insulators.

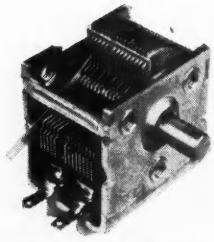
Insulated winding wires of all types including "Lewmex," "Lewcosol" and a new high-temperature winding wire "Lewkanex" were shown by the London Electric Wire Co., and Smiths, Ltd. They also included bare and insulated copper flexibles and braids, "Glazite" connecting wires and insulated resistance wires. A range of molybdenum products by the Vactite Wire Co., Ltd., included heavy wires and tapes for furnace windings and fine and superfine wires and tapes for electric lamps and radio valves. Insulators for applications in the electronic industry which included a range of "Hylumina" components by K.L.G. Sparking Plugs, Ltd., were illustrated. The designs included standard lead-through types of sealed terminals, unsealed clip-in lead-through connectors, condenser bushings and anti-corona insulators. This material, compared with conventional ceramics, is very hard and strong and will withstand high temperatures.



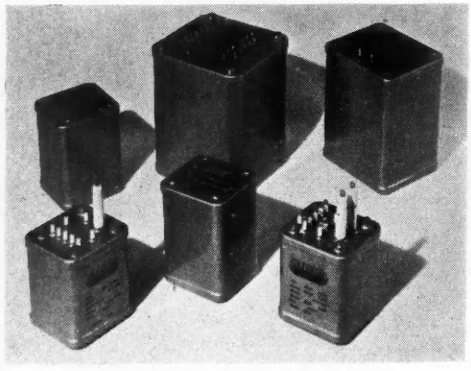
Dubilier "Terecap" capacitors

Below: Egen sub-miniature pre-set rotary potentiometer





Above: Plessey type "W" 2-gang miniature tuning capacitor



Gresham "Cadet" range of commercial transformers

Capacitors

Apart from a wide range of valves and tubes, Mullard, Ltd., showed a new capacitor for the first time. It is the type E7879 which has similar characteristics to the type 7864/01, but it has the advantage of a greatly increased capacitance range of 4 to 60 pF. It is particularly valuable in car radio applications where a trimmer of extended range is often essential to cater for differing input conditions imposed by diversity of aerial design and location on the vehicle.

The Telegraph Condenser Co., Ltd., showed a wide selection of capacitors in tubular construction which are suitable for working at 200 deg C. They are intended for use where high working temperatures preclude the use of other plastic film or paper dielectrics. There was also an extended range of tantalum electrolytic capacitors; a series of miniatures has been developed, primarily for use with aircraft instruments and a subminiature transistor circuitry. This company also had an interesting selection of printed circuits, among which were battery/mains receivers, sub-chassis tuner units and filters. Concurrent with printed circuits in production, new ranges of paper dielectric and electrolytic capacitors have been developed by the company for their specific use. The capacitors are vertically mounted and suitable for dip soldering.

A standard range of paper, mica and electrolytic capacitors was exhibited by the Dubilier Condenser Co. (1925), Ltd., and in addition they showed a number of specialities. Also seen were "Terylene" dielectric capacitors in metal tubes with ceramic end seals having reduced dimensions which are suitable for operation up to 125 deg C with high insulation resistance.

The increased demand for miniaturisation of components has resulted in the manufacture of a new two-gang miniature tuning capacitor, type "W," by the Plessey Co., Ltd. This capacitor was designed for use in transistorised radio receivers. Its construction ensures that correct tracking is always maintained between radio frequency and oscillator sections throughout the frequency band. A complete range of all aluminium subminiature electrolytic capacitors was also displayed, ranging from 0·1in diameter and $\frac{7}{16}$in long and having a wide application in all transistorised circuits. Products of the chemical and metallurgical division of the last-named company were also prominently featured. These included aerial rods and "Ferramic" screw cores for radio and television, memory cores and a range of ceramic valve holders. The "Ferramic" screw cores offer advantages over the conventional iron dust cores, in that coil condensers may utilise the higher permeability and lower losses of these cores to obtain higher inductances and higher Q values.

Tape Recorders

There were several interesting exhibits on the stand of Collaro, Ltd.—the new high fidelity tape transcripter (Mark III), for instance, which is designed on transcrip-

tion quality principles for live recording, recording from frequency modulated broadcasts and reproducing pre-recorded tapes. It is a twin-track model printed with four heads and runs at $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 in/sec. Also on display was a pre-amplifier designed for use with tape transcripter and a further exhibit by the same company was the four-speed gramophone transcription unit, Model 4T200. This last exhibit has a four-speed mechanism which ensures uniform speed with reproduction free from frequency modulation. Another interesting exhibit was a four-speed record changer which has several unique features and which was shown for the first time.

The Truvox, Ltd., Mark IV tape deck was presented as a further development in the requirements of commercial units of this type. Two types of playing time indicator are available and the deck can be supplied fitted either with a precision revolution counter or a large visual time indicator plate. In addition the range of Truvox tape recording products displayed included the Model R1 tape recorder, type C tape recorder amplifier, stereophonic head, radio jacks and foot controls. This company's high fidelity corner cabinet diffusion speaker is fitted with a sound chamber of unusual design and combines a bass reflex action with a novel means of reproducing the higher frequencies.

Truvox Mark IV tape deck with revolution counter

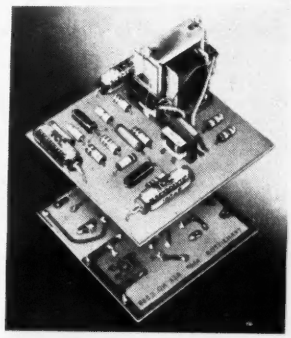
Right : Collaro 4T200 four-speed transcription unit

Switches and Plugs

Some of the latest developments in their method of resin moulding were shown by Lion Electronic Developments, Ltd. A new temperature controller/monitor was on view. This was designed for the purpose of providing precise temperature control of a liquid bath, as used in laboratories. An interesting feature is the controller which can maintain a liquid bath within a hundredth part of a degree (F) of the required temperature. Also included in their range of products were new hermetically sealed high-voltage plugs moulded in polythene on to the ends of various standard types of cables. These plugs and sockets are particularly useful for very high voltages.

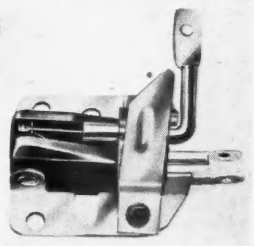
The range of rotary and push-button switches shown by N.S.F., Ltd., has been supplemented by further models and an improved version of the NSF-Oak type 14K 13 television tuner unit is now available. Channel selection of thirteen carrier frequencies is accomplished by switching incremental inductances mounted directly upon the switch unit. Further additions have been made to the range of rotary solenoids and circuit selectors for use in remote control and automation. Among the wide range of products displayed are plug and socket connectors for unit and printed circuit applications. A recently developed range of 4-, 8-, 12- and 20-way plugs and sockets, which include contacts of an unusual design, were on show at the stand of Carr Fastener Co., Ltd. Twelve resilient fingers engage with each flat plug pin to provide low contact resistance and minimum insertion and withdrawal forces.

Other interesting products included single-hole snap-in printed circuit valve holders, anti-corona high-voltage valve holders and coaxial plugs.

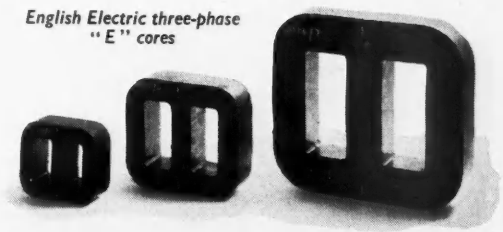


Above: Transistor amplifier on printed circuit manufactured by the Telegraph Condenser Co., Ltd.

Below: "Sonotone" pick-up cartridge manufactured by Technical Ceramics, Ltd.

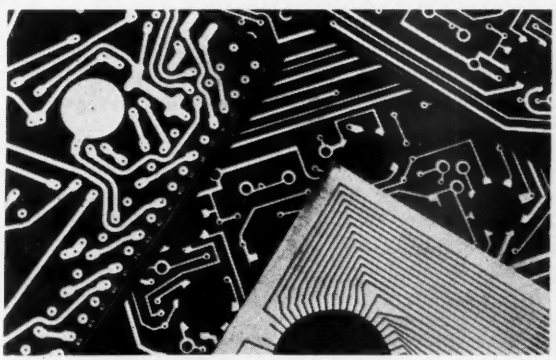


English Electric three-phase "E" cores



Transformers

The English Electric Co., Ltd., exhibited typical examples from their complete range of cores and transformers. Among the transformers shown were the single-phase hermetically sealed cast-in-resin and pin type C core transformer conforming to R.C.S. 214 Humidity Classification H1. Apart from these items the company showed a wide range of valves and a new range of power oscillators designed specifically for industrial



Printed circuits from copper-clad Tufnol

radio frequency heating equipments from 0·5 kW to 100 kW.

Several new instruments were shown in addition to the comprehensive range of radio, television test instruments and electrical measuring instruments by Taylor Electrical Instruments, Ltd. A moving coil meter which is a complete departure from the conventional type of movement was displayed; it consists of a centre coil magnet surrounded by a soft iron ring where the coil rotates around the magnet. The most important advantage is that the torque over power ratio is twice that of conventional movements. The new meter also incorporates dry balancing which ensures permanency of zero setting. A new pocket size multi-range meter having 24 ranges has been specially designed for the aircraft industry, to allow accurate measurements of voltage, current and resistance.

Among the new instruments for the radio and television service engineer, the Model 94 A television waveform and alignment generator is suitable for all television systems and covers all frequencies. An instrument which is capable of measuring mutual conductance of over 4,000 types of valves, British, American and Continental, was included in the company's range of exhibits.

The advantages of a circulating liquid coolant are combined with resin moulded construction in the transformer designed by Gresham Transformers, Ltd., to operate at high temperatures in a confined space. Among the more standardised types shown were the "Cadet" range of commercial transformers and chokes and an open type of E-core construction for three-phase operation. This type of construction is applicable to the demands of the aircraft industry since particular attention has been paid to weight reduction.

Apart from the many valves and tubes exhibited by Ferranti, Ltd., a number of transformers and chokes were displayed. Among these were the "Forth" series of miniature resin cast units and also the "Hitemp" series of high-temperature lightweight components designed for supersonic aircraft.

A wide range of iron-cored components by Haddon Transformers, Ltd., was on view and included a new series which may easily be adapted for use with printed circuits. Among their products was an improved very low frequency wide band output transformer which can deliver 1 kW of power over the frequency band of 4 c/s to 4,000 c/s. The company have also added linear saturable reactors to their range which are capable of controlling a.c. powers up to 4 kVA with relatively low d.c. controlled power.

The display by Technical Ceramics, Ltd., included a wide range of transducer sub-assemblies, covering such diverse fields as ultrasonic cleaning, echo-sounding and specialised medical equipment. Also on view were a number of binder elements in various sizes, consisting of sandwiches of barium titanate material, suitable for such applications as strain gauges, surface flatness gauges and gramophone pick-ups. Among the many items displayed by Egen Electric, Ltd., were their new sub-miniature preset potentiometers, types 173, 174, 195 and 196, providing the circuit facilities of variable potentiometers with the convenience of self-supporting mounting. Other types of potentiometers were exhibited by Colvern, Ltd., Electronic Components, N.S.F., Ltd., Painton & Co., Ltd., Salford Electrical Instruments, Ltd., Welwyn Electrical Laboratories, Ltd., and Zenith Electric Co., Ltd.

A wide variety of intricate punchings made from Tufnol together with a display of printed circuits produced from copper-clad Tufnol was also seen on the stand of the manufacturers of this electrical insulator.

Nuclear Power Plans

WHEN the House of Lords debated the nuclear power station programme, Lord Mills, Minister of Power, stated that the cost of importing fuel for nuclear power would be considerably less than importing conventional fuels. In the early years initial fuel charges would be costly but annual replacements would cost very much less and, over the life of the nuclear stations, about 20 years, uranium imports would cost from one-tenth to one-fifth of the cost of coal or oil if they had to be imported instead.

The target for nuclear power production had been trebled to take full advantage of the lead our scientists and engineers had given us. The introduction of nuclear power promised two things: to keep our imports in check and to result in the export of equipment.

The cost of the new programme to provide 6,000 MW by 1965 was £919 million, of which £742 million represented the cost of the stations and £177 million the initial uranium fuel charge. The estimate for conventional stations coming into use concurrently with these nuclear stations between 1961 and 1965 was £316 million and for the associated transmission lines £225 million. This gave the total of £1,460 million. There was already a programme of conventional stations and their transmission lines under way on which £630 million would be spent from now until the early 1960s. There would be an expenditure of £220 million before the end of 1965 in respect of conventional and nuclear stations which would not come into use until after that date. The total expenditure on generation and bulk transmission between now and 1965 would be £2,310 million. In addition it would be necessary over the same period to provide about £1,000 million for local distribution and £40 million for extra working capital, giving a total cost of £3,350 million.

Under the arrangement with the United States the U.S. would relinquish an option they had on certain Canadian supplies of uranium in favour of Britain.

The question of risks and siting of stations was kept under constant review. There was no experience yet of operating nuclear power stations of this size continuously so it could not be claimed that all the possibilities were known. But he was informed that the design of the stations was inherently safe and the system of monitoring was such that an escape of radioactive materials was extremely unlikely. But it was thought right to have the extra insurance of remote siting for the time being. There was no waste from a nuclear power station. The fuel elements would be reprocessed.

It was technically possible to put transmission lines for short distances underground but it was not feasible to keep changing from overhead to underground. The loss of power through putting cables underground was great, and it would mean more power stations, and booster stations every ten miles. The cost for one mile of overhead supergrid was £25,000; one mile of underground supergrid would cost £300,000, plus the cost of the booster stations. No addition to the "inner circle" of the supergrid was contemplated, but there would be additional links between the new stations and the inner circle.

A section on the nuclear power programme would be added to the White Paper on investment in the fuel and power industries which would be presented to Parliament shortly.

Nuclear Power and Industry

PROCEEDINGS AT O.E.E.C. CONFERENCE IN PARIS

FOUR hundred industrialists from eleven European countries and the United States attended a conference in Paris last week (1st to 5th April), the purpose of which was to describe the present state of nuclear technique and the prospects opened up for industry by the practical application of this new form of energy. The conference was organised by the O.E.E.C. and on each day was devoted to the consideration of a specific subject under the chairmanship of a leading figure in nuclear energy circles. Papers were presented by representatives of atomic energy authorities in the various O.E.E.C. countries and by industrialists who have taken part in practical achievements in this field.

Fundamental Problems

Prof. Francis Perrin, High Commissioner for Atomic Energy (France), presided on the opening day and began the proceedings by discussing the fundamental problems of nuclear energy. He traced the development of nuclear physics from the first splitting of the atom to the successful establishment of the chain reaction in uranium and the consequent development of practical nuclear reactors and major power plants like that at Calder Hall. French efforts in the field of atomic energy were at present of a limited nature but were directed almost entirely towards the development and utilisation of nuclear power to alleviate the shortage of conventional fuels. After describing the mechanisms of fission and fusion Prof. Perrin referred to the desirability of bringing about controlled fusion of D_2O atoms, but said that this development might take 20 years.

We could afford this time, however, because of the recent advances made with fission and the continuing usefulness of coal fired power stations. The world's reserves of energy including coal and oil were sufficient for 1,000 years. Fission would provide power for about 20,000 years but if fusion became a practical proposition it would provide energy for hundreds of millions of years. Finally Prof. Perrin commented upon radiation hazards and said that in nuclear power we had a new industry in which the dangers were fully realised and comprehensive measures taken to ensure the safety of operational personnel.

The next speaker was Prof. Salvetti (Italy), who dealt with reactor fundamentals and techniques. He referred very briefly to the main types of reactors at present in use or under construction and explained the mechanism of fission in some detail taking as an example the heterogeneous reactor using natural uranium as fuel.

Uranium and Thorium Supplies

Nuclear fuels and fuel cycles were then dealt with by Mr. L. H. Roddis, Jr. (U.S. Atomic Energy Commission). He said that there were four parts per million of uranium in the earth's surface so it was not a rare material. At present the United States had uranium ore reserves amounting to 60 million tons and South Africa and Canada had even more. Thorium was three times as abundant as uranium and this could be used in breeder reactors to produce further fissile materials. The development of these breeder reactors was essential to conserve nuclear fuels as they could extend the world's reserves of nuclear fuels by a factor of 500. Studies of nuclear fuel cycles played an important part in the planning of reactor development programmes. If all of the various combinations of fuel, fertile material, neutron energy, coolant geometry and moderator were considered there were more than 900 possible reactor types. In developing power reactors it was essential to make a co-ordinated approach. Reactor designers, fuel fabricators, chemical process designers and waste disposal engineers should tackle their problems jointly rather than severally. In conclusion Mr. Roddis emphasised that fuel cycles, not just reactors, were of primary concern in this growing business of nuclear power.

The final speaker on Monday was Dr. Odd Dahl (Norway), who gave a general review of reactor development, types and uses of reactors intended to provide a background for the more specialised papers presented during the conference. There were about 250 reactors of various types now operating in the world and Dr. Dahl explained that these could be divided into four categories according to their applications; research, power production, propulsion and materials production. Much effort was being put into the design and development of better reactors, but there was a definite need for a freer interchange of information.

Capital and Fuel Costs

On Tuesday morning the chair was taken by M. Pierre Rykmans, Governor General of the Belgian Congo. Speaking as a layman he discussed the new prospects opened up by the development of nuclear energy. Mr. J. A. Jukes (U.K.A.E.A.) then examined the cost factors which made up the total cost of nuclear power. Capital costs were high but would fall as development proceeded. However, fuel costs could be made low and there were possibilities of making them very low. This relationship between capital and fuel costs was the reverse of that with coal and oil fired stations. Nuclear power costs were more likely to be akin to hydro-electric costs. In England a 300 MW nuclear station with two reactors would cost about £130/kW, the percentage of the total cost for various items of the plant being—reactor construction 7 per cent, reactor plant and equipment including pressure vessel and graphite 25 per cent, heat exchangers, blowers, etc., 26 per cent, power house electrical equipment 22 per cent, cooling towers, administration services, etc., 11 per cent, and contingencies 9 per cent. Mr. Jukes also considersd the effects of load factor. In the case of early nuclear power stations with high capital costs, base load operation was essential, but within the next twenty years capital costs should have fallen sufficiently to make them capable of economic use at less than base load in many areas.

Mr. Richard Baumgartner (France) then dealt with the energy problem in Europe and the place of nuclear energy. He felt that nuclear energy would not be competitive in the early stages and the main aim would be to develop techniques and train personnel. When costs were reduced development could be accelerated. This would depend largely on the development of the plutonium breeder reactor. Finally, if the controlled fusion of light elements could be mastered it would revolutionise power production.

During the remainder of the session Mr. L. Rotherham (U.K.A.E.A.), M. Taranger (France) and Mr. Simpson (U.S.A.) respectively described the Calder Hall (184 MW),

Marcoule (30 MW) and Shippingport (90 MW) nuclear power plants. They showed that in the United States it was a natural step to proceed from the water-cooled Hanford plutonium producing piles to pressurised water power producing reactors and, like much atomic energy development, the early applications were to submarine and aircraft carriers before civilian applications exemplified by the Shippingport project. Many other types of reactors had been studied in the United States but at the moment the pressurised water reactor seemed the most serious competitor of the Calder Hall type.

We knew less of work in the U.S.S.R. but probably development had followed some of the same lines as the American. The small graphite-moderated, water-cooled experimental reactor near Moscow was uneconomical and more recently preliminary studies of a reactor moderated by heavy water and using gas cooling had been published. One could deduce that in Russia, as in the United States, supplies of enriched uranium and heavy water were readily available. In this respect conditions were different in Western Europe and developments therefore tended to follow a different line. The only other country with a substantial achievement in nuclear power production was France. Starting later than, and independently of, the United Kingdom, they had arrived at a system using a graphite moderator and gas cooling and capable of using natural uranium as fuel. From the engineering viewpoint Calder Hall and Marcoule showed marked differences, but they were basically of the same type and well matched to the needs of Western Europe.

On Wednesday there was a short session devoted to a consideration of radioactive isotopes, while on Thursday, when industrial aspects of nuclear energy were discussed, Mr. A. L. G. Lindley (G.E.C.-Simon-Carves Atomic Energy Group) took the chair and in a brief introductory address reviewed the industrial prospects of nuclear energy and commented on some of the technical problems involved. For power generation the largest possible reactors were the most favourable and in this respect the pressure vessel was the governing factor. To increase efficiency higher steam temperatures and pressures were necessary and this would mean higher fuel element temperatures. To permit of these developments a whole range of new materials would be required.

The next speaker was M. Goldschmidt (France) who dealt in great detail with the chemical and metallurgical processes involved in dealing with uranium from the treatment of the ore to the separation of fission products and fissile materials from fuel that has been irradiated in various types of reactors. Special materials for reactor construction were then discussed by Prof. Kiessling (Sweden). After M. Pierre de Haller (Switzerland) had spoken on mechanical handling equipment in the nuclear industry Dr. D. Taylor (U.K.A.E.A.) outlined the contributions of the electronics industry to the nuclear energy programmes and described some of the main types of instrument which were required.

Programmes Outlined

On the last day of the conference Mr. J. C. C. Stewart (U.K.A.E.A.) explained that the British object was to install nuclear power plant at a rate at least matching the growth of our overall energy requirements. By 1965 between 5,000 and 6,000 MW of nuclear plant would be installed and this would save about 18 million tons of coal per year. Although these reactors would be of the Calder Hall type a vigorous programme of investigation into other systems was being conducted. Large as the programme might now appear, British industry would still be capable of exporting many nuclear power stations, so contributing to the energy needs of other nations.

M. Jules Gueron then described the French nuclear energy programme. He said industry was progressively taking its place in nuclear engineering and numerous industrial groups were now being formed. The country's general planning now included the production of electricity in nuclear power stations of the Marcoule/Calder Hall type, at least 850 MW being planned for 1965. This should represent 5 per cent of the consumption anticipated at that date, and result in an annual saving of two million tons of imported coal. By 1975 about 3,000 MW of nuclear generating plant should be in service.

Speaking on the United States civilian atomic energy programme, Dr. A. S. Bishop explained that in view of the abundance and low cost of conventional fuels they had been influenced less by the necessity of producing nuclear kilowatts at an early date and more by the desire to develop the technology of somewhat advanced concepts which showed greater economic promise. It was recognised that many of the reactor concepts and much of the technology being developed in the United States were of appreciable importance to countries abroad which had a critical need for the development of new power sources. The United States had expressed willingness to work with such nations in the development of atomic energy for peace-time purposes, and bilateral agreements had been made with nearly 40 Governments. Under these agreements large amounts of enriched uranium, heavy water, and numerous other important materials and services had already been made available to foreign nations, with prices identical to those required of domestic consumers.

Complaint Against L.E.B.

A THREAT by the London Electricity Board to issue a writ of libel against a former Minister of Supply, Mr. George R. Strauss, Labour M.P. for Vauxhall, was the subject of a complaint by him in the House of Commons on Monday.

Mr. Strauss said that a business colleague had called his attention to the method, contrary to normal commercial practice, by which the Board disposed of its old and useless cables. He became convinced that this method meant that the cables were sold at prices well below what they should fetch and could fetch, and that a substantial amount of public money was being lost every year, and suggested to the Paymaster General that the matter should be investigated rather urgently because the price policy in this matter would be decided soon. He did not accuse the Board or any of its officers of dishonesty or any lack of integrity. He did declare a personal interest which was very remote indeed. He was invited to discuss the matter with the Board's chairman, who later wrote asking him to withdraw the criticisms he had made in his letter to the Paymaster General. This he was not prepared to do.

"I then had a letter," said Mr. Strauss, "asking me again to withdraw those criticisms on threat of legal action if I did not. This was followed by a solicitor's letter which emphasised the threat. Finally, on Friday, my solicitors received a letter from the solicitors to the Board saying that they were issuing a writ for libel against me this week." This was in respect not of any public statement he had made, but of the criticisms, suggestions and comments he had made in a letter to the Minister responsible for that Board. It seemed to him that this raised a grave matter affecting the rights and duties of Members of Parliament.

The Speaker having ruled that Mr. Strauss had made out a *prima facie* case entitling his complaint to be given priority, Mr. Butler, Home Secretary and Lord Privy Seal, moved that the matter of the complaint be referred to the Committee of Privileges. This was agreed to.

VIEWS on the NEWS

By REFLECTOR

PULVERISED fuel ash, once an embarrassment to the electricity supply authorities, is becoming of value as a building material. It can also have other uses. The current issue of *Electricity* (the C.E.A.'s journal) tells how it has been employed for filling tunnels in the Woolwich area. These tunnels were excavated in the past to secure chalk and the pillars which supported the roof have gradually deteriorated with the result that there has been subsidence, endangering houses which had been built above the tunnels. Engineers of the London County Council tried various ways of filling in the tunnels but found by experiment that pulverised fuel ash from London power stations was the most satisfactory material for the purpose. The ash is water-borne; the water drains away and leaves a solid filling of ash in all the tunnels and interstices. It is estimated that about 60,000 tons will be disposed of in this way.

* * *

It seems that there has been an almost sudden realisation that the objections to a Channel Tunnel which were more or less valid for a half-century or so have lost their effect. Consequently hopes of constructing the tunnel have recently been revived. An interesting account of the beginnings and history of the British and French companies formed for the purpose was given by a special correspondent in a recent issue of *The Times*. Somewhat strangely, the author nowhere mentions that the railway through the tunnel would have to be electric, although he does refer to the severe ventilation problem which the project presents. No doubt he took this for granted. Such a tunnel would be an interesting electric traction job, and of course the ventilation would have to be electrical.

* * *

Electrical men, no less than the tenants, will have been glad to learn that the Government has decided to stop the "racket" by which landlords of blocks of flats take electricity "in bulk" and retail it at exorbitant prices to their tenants. It will be agreed that landlords are entitled to recover the cost of meters and wiring which they may provide but to charge anything up to 1s per kWh is going some way beyond this. The electrical industry was entitled to protest because it limited the sale of equipment. The new clause in the Electricity Bill now puts electricity on the same footing as the gas industry which had already secured protection for its consumers.

* * *

The Elliott Co. of Ridgway (Pa.) has decided not to quote for hydro-electric plant as long as foreign tenders are accepted and it has threatened to convert its water-turbine works to other work if Government policy is not altered. The company cites a recent case in which the Corps of Engineers called for tenders for two 42 MW generators. It lists the following results:—Brown-Boveri $1·4 million, English Electric Co. $1·6 million, Elliott Co. $1·8 million and three other American companies over $2 million. "This," the company says, "reconfirms our previous conclusion that it is a waste of time to bid on Government projects when foreign manufacturers are permitted to bid." It is suggested that the President should instruct the Department of Defense to ignore foreign tenders under an Executive Order interpreting the Buy American Act.

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A reward of 5s is paid by the Meteorological Office to the finders of instruments parachuted from its "weather balloons" but the Office will have to pay more than this in respect of some instruments which recently fell across high-voltage cables belonging to the North of Scotland Hydro-Electric Board. Two lines were brought down and one was burned out; the supply was cut off from the surrounding area. It is reported that the Board is sending a bill to the Met. Office for the expense involved.

* * *

One of the lady guests at last week's dinner of the Illuminating Engineering Society attracted a good deal of interest by reason of her "illuminations." These consisted of a number of miniature electric lamps arranged in the manner of sequins or jewels upon the collar and hem of her dress. The effect was particularly marked when the general lighting was reduced during the dancing.

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Looking through the files of the *Electrical Review* of eighty years ago—it then bore the name of the *Telegraphic Journal and Electrical Review*—I came across the following early reference to the telephone in the issue of 15th April, 1877:—

> "There can be no question now that the telephone is to be regarded as a practical success. There are so many observers and so many unbiased witnesses whose accounts have reached us that no further room is left for any uncertainty on the point. A very interesting article from the New York correspondent of the *Standard* appeared in that paper on Thursday. He details very accurately the two different methods—that of Dr. Bell and that of Mr. Elisha Gray—which are struggling for supremacy in the States. Dr. Bell's will appear to be the more perfect of the two, although Mr. Gray has succeeded in transmitting the sounds over far greater distances. The longest journey which they have had to travel has been from Chicago to Detroit, a distance of 284 miles. A concert was to be held on the 2nd inst. at the Steinway Hall in New York, to which the New Yorkers were to be admitted at a dollar a head in order to listen to a performer playing in Philadelphia, some 90 miles away. It is somewhat strange that so little has been heard of this marvellous invention in England, for, apart from the interesting exhibition made by Messrs. Wray at the conversazione of the Society of Telegraph Engineers [now the Institution of Electrical Engineers] nothing whatever appears to have been done in this country."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The president of the Electrical Power Engineers' Association for 1957-58 is **Mr. L. Benallick,** Associate I.E.E., district engineer of the Swansea District, South Wales Electricity Board. Before vesting day Mr. Benallick was assistant distribution engineer with the Swansea Corporation Electricity Department. He has been a member of the E.P.E.A. for twenty-seven years and since nationalisation has played a prominent part in salary negotiations as chairman of the No. 8 District Joint Board. Mr. Benallick is a member of the National Joint Board and the National Joint Advisory Council for the Electricity Supply Industry. He will attend as one of the Association's representatives at the 1957 British Electrical Power Convention. He was formerly treasurer and subsequently hon. secretary of the West Wales (Swansea) Sub-Centre of the Institution of Electrical Engineers from 1945 to 1953.

Mr. L. Benallick

Mr. H. G. Bell, M.Sc.Tech., M.I.E.E., is retiring from the position of chief engineer of the North Western Electricity Board in September next on reaching the age of sixty-five.

Mr. H. G. Bell

Mr. Bell was educated at Manchester Central High School, Manchester College of Technology and Manchester University. He served as an infantry officer during the 1914-1918 war, and following infantry service he was seconded to the Admiralty for submarine research work. He joined the Metropolitan-Vickers and Westinghouse Companies in 1919, holding various positions with them including that of liaison officer in America. While still with Metropolitan-Vickers in 1922 he ran the first B.B.C. North Western transmitter, "2ZY," which then operated from Trafford Park.

He joined the Central Electricity Board in 1930 as chief technical engineer for the north-west, leaving in 1946 to become chief engineer and manager of the Stretford and District Electricity Board. In 1948 he was appointed manager of the North Western Electricity Board's No. 1 (Manchester) District, and became chief engineer of the Board in 1954 on the retirement of Mr. O. Howarth.

Mr. H. Maxwell Rostron, M.I.E.E., has relinquished his appointment as engineer and general manager to the Liverpool Overhead Railway Co., which he has held since 1943, and has gone into practice as a consulting engineer and transport adviser at No. 13, Rumford Street, Liverpool, 2. As engineer and general manager of the Liverpool Overhead Railway he had sole charge of all the engineering works, rolling stock, equipment, and maintenance, together with administrative authority. Mr. Rostron was previously with the Pirelli-General Cable Works, Ltd., the English Electric Co., Ltd., and James Scott, Ltd.

Bristol University is to confer the honorary degree of Master of Science on **Mr. A. N. Irens,** M.I.E.E., chairman of the South Western Electricity Board. This was announced by Professor G. H. Rawcliffe, the University's Professor of Electrical Engineering, at the annual dinner of the Western Centre of the Institution of Electrical Engineers, held at the Grand Spa Hotel, Clifton, on 29th March. The honorary degree will be conferred in July at the Bristol University Degree Congregation.

Mr. E. Reader, chief purchasing officer of Brook Motors, Ltd., has resigned owing to ill-health, and **Mr. R. Garside,** who has been his assistant for many years, has succeeded him as chief purchasing officer.

This year's associateship presentation ceremony of the Birmingham College of Technology, held in the Town Hall on 30th March, was of special interest to the electrical industry, in that an Honorary Associateship of the College was conferred on **Sir Harry Railing,** chairman of the General Electric Co., Ltd. The presentation was made by Mr. J. J. Gracie, director of the G.E.C., Witton, and chairman of the governing body of the College.

Sir Harry Railing (left) receiving from Mr. J. J. Gracie the Honorary Associateship of the Birmingham College of Technology

Mr. J. A. Aldington, B.Sc., Ph.D., M.I.E.E., F.R.I.C., F.Inst.P., F.I.E.S., has been appointed chairman of Submarine Cables, Ltd., in succession to **General Sir William Morgan,** and **Mr. L. S. Crutch,** a director of Siemens Brothers & Co., Ltd., has been elected to the board to fill the vacancy caused by General Morgan's resignation.

Mr. F. Shakeshaft, O.B.E., A.M.I.E.E., M.Inst.F., mechanical engineering consultant of the Central Electricity Authority, has at his own request relinquished his appointment at the end of March.

Mr. F. Shakeshaft

Mr. Shakeshaft, who received his technical education at Preston Technical College, served first with a firm of engine, boiler and general engineers and then as turbine designer and power station specialist with the Dick Kerr Co. and the English Electric Co., Ltd. In 1930 he joined the Central Electricity Board as assistant engineer (supply) and later was the Board's power station development engineer. Upon the reorganisation of the electricity supply industry in 1948 he became generation design engineer of the Authority and three years ago he took up a new appointment to concentrate on future design and generation problems.

Mr. R. Hudson, export manager of Dimplex, Ltd., left for the United States this week for a six weeks' tour of the U.S.A. and Canada. Mr.

Hudson will spend part of the time at the U.S. World Trade Fair to be held at the Coliseum, New York, where Dimplex has a stand.

W. T. Henley's Telegraph Works Co., Ltd., has appointed **Mr. P. H. Scrine** as its manager for India in succession to **Mr. F. Moore,** who retired on 9th March after thirty-three years' service, including five years as manager. Mr. Scrine has been with Henley's for over twenty years. He joined the company in 1936 and was appointed to the Secretary's Department in the same year. During the last war he served with the Royal Artillery. In 1947 he went to India as an assistant at Henley's Calcutta branch, and in 1950 he was transferred to Karachi as manager there. He returned to Calcutta as personal assistant to Mr. Moore in 1952, and was appointed assistant manager for India in July, 1953.

Mr. J. M. Furnival, one of the pioneers of air radio, has retired from the position of general manager of Marconi Instruments, Ltd., and on Tuesday last he was entertained to luncheon when the host was Sir George Nelson, Bt., chairman of the English Electric group of companies. Among the many distinguished people who accepted invitations to be present were the Parliamentary Under-Secretary of State for Air, Wing Commander C. I. Orr-Ewing, Marshal of the Royal Air Force Sir John Salmond, and many well-known radio personalities from the early days of the Marconi Co., including Mr. H. J. Round and Mr. C. S. Franklin.

Mr. J. G. Holmes, A.R.C.S., B.Sc., F.Inst.P., A.M.I.E.E., who writes in this issue on "Optical Louvres" (page 659), is technical director of Holophane, Ltd. He was educated at Burford Grammar School, Oxford, and the Royal College of Science, London, before going to Chance Brothers, Ltd., where he was head physicist from 1929 to 1946. He was appointed chief technical officer of Holophane, Ltd., in 1946, and technical director in 1955, in charge of prismatic lighting design, research, application and photometric science.

Mr. J. G. Holmes

Mr. Holmes has written many articles on glass, and is a Fellow of the Society of Glass Technology, having served many years on its Council. Since joining Holophane he has specialised in the scientific application of light control, and presented papers on this subject to the Illuminating Engineering Society; he was president of the I.E.S. in 1951-52 and is now hon. secretary. He serves on the Parliamentary and Scientific Committee, and on technical committees of the British Standards Institution and the Department of Scientific and Industrial Research.

Mr. C. E. Penrose, chairman of the E.C.A. Plymouth Branch, welcomes the Lord Mayor of Plymouth at the Branch annual dinner-dance. The group also includes members of the Branch Committee

After forty-seven years with Anderson, Boyes & Co., Ltd., Motherwell, **Mr. R. Russell,** a director of the company for the past thirty years, has retired. His retirement was marked by the presentation to him of a television set from the directors and staff. The gift was presented by Mr. J. Anderson, managing director. Mr. Russell was president of the West of Scotland Branch of the Association of Mining Electrical and Mechanical Engineers in 1940.

The annual luncheon of the **British Compressed Air Society** was held on 28th March at the May Fair Hotel, London. Mr. H. Cunliffe, general manager, Shell Mex & B.P., Ltd., being the chief guest. The annual general meeting was held later when the following officers were appointed:—President, Mr. G. F. Davies (Hick, Hargreaves & Co., Ltd.); vice-president, Mr. W. B. Rainbird (Climax Rock Drill & Engineering Works, Ltd.); ex-officio council member (immediate past-president), Mr. J. R. Ouertier (Consolidated Pneumatic Tool Co., Ltd.); and hon. technical director, Mr. T. C. Hore (Holman Brothers, Ltd.).

The Plymouth Branch of the **Electrical Contractors' Association** held its annual dinner and dance at the Duke of Cornwall Hotel, Plymouth, on 3rd April, and among the many guests were the Lord Mayor and Lady Mayoress of Plymouth, the local manager of the South Western Electricity Board (Mr. N. Axford) and the chairman of the South-Western section of the E.C.A. (Mr. J. Allan).

The Lord Mayor proposed the toast to the Association, and in so doing he said that members of the Association had played a big part in the rebuilding of the city. Responding to the toast, Mr. F. R. Madge said that the Association represented free enterprise electricity; they were on the friendliest of terms with the South Western Electricity Board in Plymouth. The chairman of the Branch, Mr. C. E. Penrose, proposed the toast to the guests, and this was replied to by the Town Clerk, Mr. S. Lloyd Jones.

The Engineering & Lighting Equipment Co., Ltd., announces that **Mr. H. E. G. Watts,** A.M.I.Mech.E., Associate I.E.E., has been appointed general sales manager. Mr. Watts is a member of the Council of the Illuminating Engineering Society and is a well-known lecturer and writer on street lighting and other lighting subjects.

Mr. H. E. G. Watts

Mr. J. N. L. Anderson, on his retirement after twenty-five years as district engineer for North Angus in the South Caledonia Area of the North of Scotland Hydro-Electric Board, has been presented with an inscribed gold watch from the Montrose, Brechin, and Forfar staffs. The presentation was made recently by Mr. E. Scott, Montrose assistant district engineer. From the South Caledonia Area Mr. Anderson received a wallet of notes, presented by Mr. A. Grant, area manager.

Mr. J. P. Jamieson has been appointed sales manager for the industrial and automotive range of portable electric tools of Black & Decker, Ltd. Mr. Jamieson takes over the position recently relinquished by Mr. F. A. Field, who has become managing director of Eutectic Welding Alloys, Ltd.

Mr. J. P. Jamieson

Mr. Jamieson joined the Black & Decker organisation twenty years ago and in 1939 he was transferred to Manchester

to be responsible for the company's sales in Lancashire, Cheshire, North Wales, Yorkshire, and North Midlands. Early in 1956 he joined the head office staff at Harmondsworth as acting marketing manager.

The Midlands Electricity Board announces the appointment of **Mr. G. S. Buckingham,** B.Sc.(Eng.), M.I.E.E., its chief purchasing officer, as chief engineer in succession to Mr. G. F. Peirson who, as we have already reported, has been appointed deputy chairman of the Board.

Mr. Buckingham was educated at Norwich School and at the Faraday House Electrical Engineering College, London, where he gained the diploma and gold medal. From 1924 to 1926 he was with the Yorkshire Electric Power Co., Leeds, in the mains department as personal assistant to Mr. W. B. Woodhouse. In 1926 he was appointed to the staff of Pirelli-General Cable Works, Ltd., Southampton, first as senior contracts engineer and later as district engineer and branch manager for the Midlands, based in Birmingham. When the electricity supply industry was nationalised in 1948 he was appointed chief purchasing officer of the Midlands Electricity Board. Mr. Buckingham has twice served on the Committee of the South Midland Centre of the I.E.E. and he is past chairman of the Supply and Utilisation Group of the I.E.E. in Birmingham. He has been a member of the Council of Faraday House Old Students' Association, and he is a member of the Council of the Birmingham Electric Club.

Mr. Basil Z. de Ferranti, the younger son of Sir Vincent Z. de Ferranti, has been appointed a director of Ferranti, Ltd. After graduating at Cambridge University, he undertook a course of training with the Napier Co., and subsequently joined Ferranti, Ltd., in 1953 to develop the "Fridge-Heater" domestic heat pump. Later he became manager of the Domestic Appliance Department, a position which he still holds.

Mr. B. Z. de Ferranti

Mr. C. L. Old, B.Sc.(Eng.)Lond., M.Sc.Tech.Manchester, M.I.C.E., principal of the College of Technology, Wolverhampton, has been appointed group education officer of Vickers, Ltd. It is expected that he will take up his appointment on 1st September.

Approximately seventy members and guests attended the spring meeting of **The Lightmongers,** the event being a dinner held at the Old Red House (Pimm's Restaurant), Bishopsgate, London, on 4th April. The summer meeting will take place on Friday, 28th June, and on this occasion the M/V *Queen Elizabeth* has been specially chartered and members and ladies will embark at Westminster Pier at 6.30 p.m., returning at 10.30 p.m.

Mr. D. C. Lorkin, F.C.I.S., joint managing director of Lancashire Dynamo & Crypto, Ltd., a director of Lancashire Dynamo Holdings, Ltd., and chairman of Crypto, Ltd., has completed twenty-five years at the Willesden Works of L.D.C. To mark this occasion in their customary manner, the company has presented Mr. Lorkin with a gold watch. The presentation, before some thousand employees and their friends at the company's annual dance and cabaret on 5th April, was made by Mr. J. G. Shaw, founder of the Willesden Works of L.D.C., who first appointed Mr. Lorkin to the company in 1932.

Mr. D. C. Lorkin

The annual parents' day and prize-giving of apprentices of the London Division of the **Central Electricity Authority** will be held on 3rd May. After inspecting apprentices' work at the Apprentice Training School adjoining Bankside generating station, visitors will proceed to the Institution of Electrical Engineers where tea will be served and the prize distribution will take place. Sir Josiah Eccles, deputy chairman (operation) of the C.E.A., will give an address and Lady Eccles will present the prizes.

With the setting up of a technical committee the Society would give a more effective service, said Mr. W. E. Harper, president of the **Illuminating Engineering Society,** at the annual luncheon meeting of the Liverpool Centre last week. The guests at the luncheon included the Lord Mayor of Liverpool, representatives of Manchester Centre, I.E.S., Liverpool Architectural Society, and Liverpool University. The guest speaker was Mr. Cyril Washbrook, the Lancashire county cricketer. Mr. Fred J. Burns presided. Proposing the toast to the City of Liverpool, Mr. Harper said that professional societies, such as the I.E.S., could not exist as exclusive coteries of the initiated. They existed to serve the community of which they were part. The art and science of lighting touched all, from the lighting of homes to the navigation lighting of the great port of Liverpool. Mr. Harper paid tribute to Mr. C. C. Smith (city lighting engineer) as one of the foremost public lighting engineers in the country.

The annual dinner and dance of the **Leicester Electrical Society** was held at the Grand Hotel, Leicester, on 5th April. Mr. R. H. Gill, chairman of the Electrical Contractors' Association proposing the toast of the Society, said that the electrical industry's growth in the last ten years had been phenomenal, and the aims and objects of the Society would ensure prosperity for its members. Good relations and good education were essential in a young and virile industry and the ideals of the Society were most laudable. Mr. K. Broom, president of the Society, said that it was the object of the Society to give members an opportunity to meet experts in all fields.

The first annual general meeting of the recently formed **Birmingham Electrical Golfing Society** was held recently in Birmingham. The president, Mr. A. Jennens, stated that the Society had enjoyed a very successful year and looked forward to new members being enrolled in the near future. Membership application forms are obtainable from the hon. secretary, Mr. F. C. Mealing, 204/206, Newhall Street, Birmingham, 3. The following officers and committee were elected for 1957/8: Messrs. J. Walker (president), W. Horrocks (captain), T. C. Browne and P. M. King (general committee), F. C. Mealing (hon. secretary/treasurer), F. C. V. Bates and H. R. T. Ball (hon. auditors).

OBITUARY

Mr. Douglas Campbell, former agent for W. T. Henley's Telegraph Works Co., Ltd., in Dublin, died on 8th March. He had been agent for Henley's for thirty-three years and retired at the end of 1956 when the agency was taken over by Messrs. Strangfords.

Mr. A. W. Isenthal, M.I.E.E., chairman and founder of I.A.C., Ltd., died on 31st March in his ninetieth year, after a long illness.

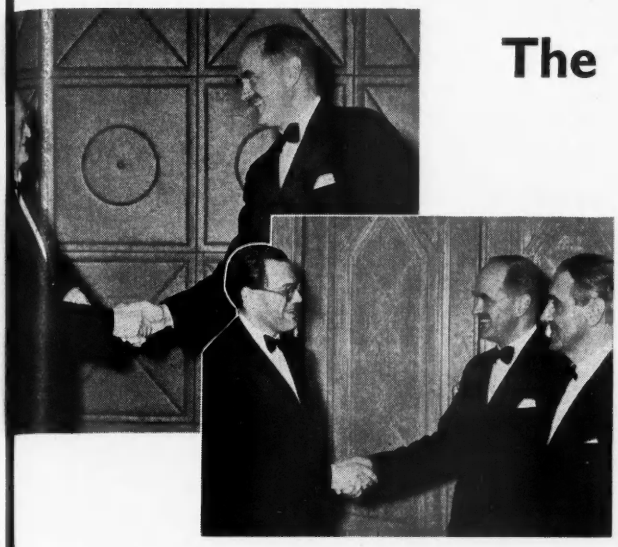
Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £197 0s 0d
COPPER, H.C. Electro	ton £244 10s 0d
Fire Refined 99·70%	ton £243 0s 0d
Fire Refined 99·50%	ton £242 0s 0d
COPPER Tubes ..	lb 2s 4½d
Sheet	ton —
H.C. wire and strip ..	ton £291 5s 0d
LEAD, English	ton £113 5s 0d
Foreign	ton £112 0s 0d
MERCURY	flask £86 0s 0d
TIN, block (English) ..	ton £776 10s 0d
ZINC, G.O.B. Foreign	ton £99 5s 0d
Electrolytic	ton —
BRASS Tubes (solid drawn)	lb 1s 11½d
Sheet	ton —
Wire	lb 2s 8½d
PHOSPHOR BRONZE Wire	lb 4s 0½d
PLATINUM	oz £34 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 27d—27½d

The Role of the Supervisor

Annual Dinner of the A.S.E.E.



Top : The President (Sir Harold Bishop) greets Mr. H. W. Swann. Below : Mr. Reginald Maudling, M.P., Sir Harold Bishop and Mr. E. A. Bromfield (general secretary)

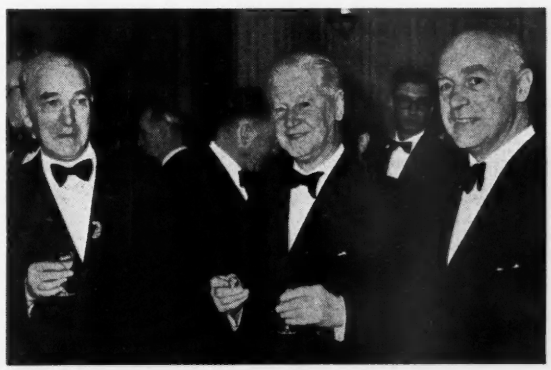
THE annual dinner of the Association of Supervising Electrical Engineers was held on Friday last, when Sir Harold Bishop (president of the Association) presided over a gathering numbering about 800 members and guests.

Mr. Reginald Maudling (Paymaster General), proposing the toast of "The Electrical Industry," referred to its magnificent achievements of the last ten years, which had been of supreme importance to general industrial output. Moreover, it had now gained first place as the British exporting industry. To meet its own output in kWh which was doubling every ten years, the Central Electricity Authority in conjunction with the Atomic Energy Authority had been foremost in the exploitation of the possibilities of uranium.

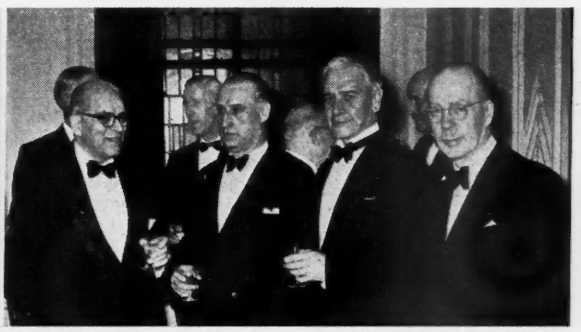
The whole history of technology had shown that its advances must be backed by technical ability in applying the resulting gain of knowledge by men of the kind represented by members of the A.S.E.E. Speaking of industrial output generally, the Minister said that an annual increase of 4 per cent in production would barely suffice to maintain an advance in the living standards of 6 per cent in the face of competition from other countries, in which the tendency was to reverse the incidence of the two figures. Export would become more difficult with the coming of the European free trade area without the protection of a tariff barrier and reliance would have to be placed more than ever before on ability to provide better qualities of goods at lower prices. The electrical industry, Mr. Maudling said, had shown the way.

Responding, Sir Vincent de Ferranti expressed regret at the absence through illness of Mr. Butler (national chairman, A.S.E.E.), who had had much to do with the starting of the electrical exhibition, which was of ever-widening scope. All electrical development had emerged from Faraday's discovery of the principle of electro-magnetism in 1831 with the subsequent technical advances made practicable by Dr. S. Z. de Ferranti in his development of high-voltage alternating current. Money resources were necessary to turn labour into new developments and the nearer to the consumer these were the greater the cost. These resources must be provided by industry. Action by Government or other outside bodies had retarded development from the 1882 Act onwards.

The toast of "Our Guests" was proposed by the president, who referred to the presence of many senior members of Government Departments and of the Forces, in addition to those eminent in the electrical profession and industry, as showing a genuine interest in the work of the Associa-



Sir Josiah Eccles, Sir John Dalton and Mr. C. T. Melling



Left : Messrs. E. R. Wilkinson, C. R. King, B. E. Gray and A. V. Milton. Right : Sir George Barnett, Messrs. S. J. Emerson, A. B. Mann and A. G. Ramsey

tion. The Paymaster General, he said, was continuing his connection with the electrical industry, which he had previously had as Minister of Supply, by his present responsibility for representing the Minister of Power (Lord Mills) in the House of Commons and by steering the new Electricity Bill through Parliament. The interest of guests from H.M. Forces lay in the help given by the Association to young men on leaving the services for civil life. Among those mentioned were Sir Josiah Eccles, who would have much to do with providing 19 nuclear power stations (thus saving 18 million tons of coal a year) by 1965; Col. B. H. Leeson, whose help in connection with the exhibition had been most valuable; and Mr. B. L. Metcalf, who was engaged on increasing the production of coal through improved methods. He also referred to Dr. Ferranti as the pioneer of modern methods of electricity supply, not only in this country but also in the whole world. Sir Harold concluded by mentioning the importance attached by the Institution of Electrical Engineers to the status of supervising engineers and technicians, consideration of which had been neglected in the past.

In response, Mr. B. L. Metcalf (chief engineer, National Coal Board) gave a reminder that, despite the coming of nuclear power, reliance upon coal for producing power would for long be necessary. The interest taken in education and training by the Coal Board was indicated by its "ladder plan," for which one day off was allowed each week. All men should round off their training by joining an appropriate body, such as the A.S.E.E. with its diploma scheme and other educational activities. In a recent visit to Russia he had observed that about two-thirds of such an organisation consisted of women. He also emphasised the importance of efficient deployment of technical staff members.

THE 275 kV SUPERGRID

In a lecture to the American Power Conference in Chicago at the end of March Mr. F. J. Lane, deputy chief engineer (transmission) of the Central Electricity Authority, said that last year 511 circuit-miles of 275 kV overhead line had been erected and thirty-five 275 kV circuit-breakers and twenty 120 MVA, 275/132 kV auto-transformers had been installed in Great Britain. Thus, an appreciable portion of the supergrid had been brought into operation and the plan which had been prepared in 1950 to improve operating conditions had begun to take definite shape. In the course of construction certain minor difficulties had been experienced, but these were not more than would be expected, considering that so much of the equipment was of a type not hitherto tried in service. In fact, everything pointed to the successful establishment of a system which would meet the expanding needs of the country in terms of load and generating plant for some years to come, and in so doing would make its own special contribution to the country's general economy and standard of living.

After describing the genesis of the supergrid, he went on to explain its two functions, namely, interconnection, to minimise the amount of spare plant required; and bulk transmission of power from stations built near the coalfields instead of transporting coal long distances. The major developing coalfields, he said, were those in the Midlands and Yorkshire from which heavy transport of energy, either as coal or electricity, would be necessary to the north-west (Manchester and Liverpool) area and to the east and south-west (London and Bristol). It was therefore decided to provide lines with a carrying capacity of 375 MW per circuit from Yorkshire to Scotland, where interconnection was the main consideration; and lines with a capacity of 550 MW per circuit between Yorkshire, the Midlands and the southern part of the country.

For the lines from Yorkshire northwards the twin conductor 0·175 sq in arrangement had been adopted and for those southward a similar arrangement with a conductor cross-section of 0·4 sq in copper equivalent. The latter arrangement had advantages in current carrying capacity and line reactance over a single 0·45 sq in conductor and the voltage could be easily increased to 380 kV without a dangerous increase in corona or interference limits. The basic design of the 2 by 0·4 sq in lines included electrical clearances which were adequate for this higher voltage, although no lines operating at this voltage would be required within the next ten years. Investigations were also proceeding into the possibilities of applying insulation suitable for 380 kV and a project was under consideration for increasing the voltage of one line to this value so that experience could be gained in varied atmospheric conditions.

The service period was too short, said Mr. Lane, to admit of much comment on experience. Certain designs of spacer had shown serious signs of failure even before the lines had been made alive and replacement programmes had been necessary. Both porcelain and toughened glass insulators had been widely used and there was no technical discrimination between them.

Details were given of the design and construction of the transformers, substations, switchgear and protective equipment on lines similar to those which have already appeared in the *Electrical Review*.

News from Australia

From a Correspondent

The Australian Broadcasting Control Board is considering the extension of television to other States (New South Wales and Victoria are so far the only States served). During October, 1956, the output of TV sets in Australia totalled 9,000, bringing the total to 25,260 sets since production began. About 30,000 to 35,000 sets had been manufactured and installed by the end of 1956.

President Consolidated, Ltd., manufacturers of electrical appliances and refrigerators, disclose a loss of £741,350 for the year to 30th June, 1956, and a receiver has been appointed for the main operating subsidiaries. The loss, the largest ever recorded by an Australian public company in any one year's trading, follows a net loss of £281,166 in the previous year. Analysis of the loss shows that £519,047 was incurred in the distribution, selling and servicing of the company's products; £211,951 in manufacturing operations of subsidiary companies; and £10,352 in the sale of land and buildings and from non-trading expenditure.

A Victorian State Electricity Commission cash and conversion loan of £2,800,000, which closed on 2nd March, was 42 per cent under-subscribed, subscriptions totalling £1,619,300 coming from 2,575 applicants. The underwriters will have to make up the balance of £1,180,700.

Electrical Engineers' Exhibition

Opening Ceremony and Luncheon

IN the absence in the United States of Lord Hailsham, Minister of Education, the Parliamentary Secretary to the Ministry, Sir Edward Boyle, performed the opening ceremony on Tuesday at the Electrical Engineers' Exhibition. He was introduced by Mr. G. H. Parker, vice-chairman of the Association of Supervising Electrical Engineers, who described the exhibition as the electrical industry's shop window, including the finest electrical equipment produced in this country. Mr. Parker drew special attention to the educational feature and thanked the national bodies and trade organisations who had assisted in its organisation. He also referred to the opportunities which the industry presented to women.

After expressing Lord Hailsham's regret at his inability to be present Sir Edward Boyle spoke of the great part played by electricity in the "second industrial revolution." But not only industry had benefited; domestic consumers, the farms and the railways had also reaped advantages from its use. Sir Edward referred to the power situation and prospects, with particular reference to nuclear power.

He went on to say that his Ministry and the local education authorities were fully aware of the importance of the electrical industry to the national economy. An expansion programme costing £70 million was being undertaken and engineering, particularly electrical engineering, would play a considerable part in that programme. In declaring the exhibition open Sir Edward congratulated the A.S.E.E. on its expansion.

Sir Harold Bishop, president of the A.S.E.E., in thanking Sir Edward Boyle, said that the great growth in the use of electricity and in electrical production had engendered a need for more and more trained men and that was why the special educational feature had been arranged. The I.E.E. had in this way participated in the exhibition for the first time. Sir Harold hoped that the older men in the industry would encourage young men to take up electrical careers.

Mr. R. F. Mathieson (deputy chairman of the Exhibition Company) announced that Stone-Chance, Ltd., had won the exhibition industrial award for their automatic fog detector and the Simplex Electric Co. the domestic award for their "Debonair" spin-dryer. The awards were then presented.

At the subsequent luncheon Mr. J. Flood (chairman of the Exhibition Company) presided and proposed the toast of the exhibition. He first read a message from Lord Hailsham and then read a long list of countries who had sent trade representatives to the luncheon. Special

View of part of the exhibition taken from the gallery. The mural picture in the end wall shows Faraday delivering a Juvenile Lecture at the Royal Institution in 1855

Sir Edward Boyle opening the exhibition

reference was made to the educational exhibits and to the help received from educational authorities headed by the I.E.E.

In the course of a response to the toast Lord Chandos said that although the exhibitors were in keen competition with one another—whatever the Government thought—they were unanimous about the value of the exhibition. He felt himself lucky to be in an industry with such exciting prospects. The harnessing of nuclear energy had led to the grafting of a new industry upon the older electrical industry; he felt sure, judging from the rapidity of nuclear fission development, that the physicists would achieve controlled nuclear fusion long before the predicted date.

As to future developments, Lord Chandos said that the possibilities of semi-conductors and low power devices were more startling than the laity realised. We were approaching a new era in traction. He considered that more thought should be given to the raising of the large sums of money required by the industry for development.

He commended the Association for the imaginative way in which the educational feature of the exhibition had been arranged. It should fire the imagination of the young people of whom the industry required so many more. There were still great opportunities for youth in this country. Lord Chandos warned engineers that the humanities must not be neglected; the art of conveying ideas was not often possessed by scientists and mathematicians. When it had been the result was remarkable. He concluded by wishing the exhibition success—success in which all exhibitors hoped to participate.

Mr. G. H. Parker introduces Sir Edward Boyle ; on his right is Sir Harold Bishop, president A.S.E.E.

THE BUDGET

PRESENTING his Budget speech the Chancellor of the Exchequer, Mr. Thorneycroft, said that in the first half of the past financial year the United Kingdom had had a surplus of about £150 million on current transactions with the rest of the world. The effects of the Middle East events had not been so serious as had been expected and there had been a surplus of £79 million in the second half of the year, but adverse capital movements had put a strain on our reserves. Although there had recently been an improvement the current surplus last year had been achieved only by the credit squeeze and the 'deliberately high level of taxation." As a result exports had risen while imports had decreased.

Between 1946 and 1956 incomes per unit of output increased by 50 per cent and that was the cause of inflation. He did not agree with those who would pursue a ruthless policy of deflation which would result in a high level of unemployment. We needed a degree of restraint and commonsense and a recognition of the common interest much greater and stronger than existed to-day. The Chancellor said that recent improvements in the situation had made him more cheerful but restrictions upon credit must continue.

Turning to his taxation proposals, Mr. Thorneycroft said that the additional tax of 1s a gallon on petrol would be removed. Purchase tax on a wide range of kitchenware, floor coverings, etc., would be reduced from 30 to 15 per cent. A number of concessions would be made to surtax payers, for it was recognised that greater incentives should be given to those who shaped the country's progress. There would also be adjustments in children's allowances and in the allowances for those over 65. Overseas trading profits earned by British-managed companies with all trading operations abroad would be exempted from income and profits tax. Investment allowances for new ship construction would be raised. An extra £1 would be charged for combined radio and television licences but there would be concessions in entertainment tax.

Next Year's Convention

WE are informed that the 1958 British Electrical Power Convention is to be held at Brighton during the week commencing 16th June. The theme will be " Electricity and World Progress—Britain's Contribution." Overseas visitors who will be in this country at the time are invited to attend the Convention and should notify the Secretary, B.E.P.C., Winsley Street, London, W.1, as soon as possible of their intention to be present.

Because of their commitments at next year's Brussels International Exhibition the electrical manufacturers have asked to be excused from participating in a Convention exhibition. It will be recalled that the British electrical manufacturing industry is organising a section in the British Industrial Pavilion at Brussels, under the auspices of the British Electrical and Allied Manufacturers' Association.

Electricity Supply Investment

DETAILS given in a White Paper published on Tuesday show that the approved expenditure of the Central Electricity Authority for 1957 is £233 million. This compares with £209 million for 1956. The total includes £120 million for generation (conventional £108 million; nuclear £12 million); £25 million for main transmission; and £88 million for distribution. Expenditure of the Scottish Boards is to be increased from £36 million for 1956 to £41 million for 1957.

Electrical Manufacturers' Progress

B.E.A.M.A. Annual Report for 1956-57

THE report of the Council of the British Electrical and Allied Manufacturers' Association for 1956-57 says that the past year was a momentous one for the British electrical industry and in the field of electrical generation a new era began. Already, following the commissioning of Calder Hall contracts have been placed for further atomic power stations and the revised programme of nuclear power development provides for 5,000 to 6,000 MW by 1965. In other fields there has been remarkable technical progress; the new transatlantic telephone cable is an example.

The number of people employed in the heavy plant section of the industry has increased but there has been less employment on the lighter side because of Government trading restrictions; the net result has been a decline of 13,000 in the personnel of the industry as a whole.

In a reference to the Monopolies Commission's report on electrical machinery and plant the Council says that the arguments advanced by the Commission in favour of its conclusions were not impressive and insufficient weight was laid on the benefits to the public which arose from many of the manufacturers' activities.

Electric Power and Productivity

Wage awards and the enormous burden of public expenditure have stimulated inflation. The failure of output to rise sufficiently to keep pace with increased wages can only be countered by improved efficiency of manufacture and more capital investment. Greater use of electric power is a principal means of raising productivity and it is recorded with satisfaction that a record capacity of 2,070 MW of generating plant was installed. It is a measure of the efficiency of the electrical manufacturing industry that, in spite of rising costs, power stations now being ordered for commissioning in five years' time will cost no more per MW than those ordered in 1948. Orders for 200 MW generators have been placed and the feasibility of 550 MW cross-compound sets is being examined.

More than one-third of the £1,200 million to be spent on the modernisation of the railways has been committed and the recent Suez crisis has shown the wisdom of pressing forward with railway electrification as rapidly as possible.

After commenting on export trade, the Council refers to the Government's inquiry into automation a report on which is to be issued in due course; some small concessions on capital investment allowances for fuel-saving plant, made by the Chancellor of the Exchequer; and representations to the Board of Trade regarding credit restrictions.

Restrictive Trade Practices Act

With regard to the Restrictive Trade Practices Act and the registration of agreements the Council says that it remains to be seen how far it will be possible to justify practices in general use throughout industry, the abolition of which, in the case of the electrical industry, may have repercussions in every other section of industry throughout the United Kingdom and on export trade.

After a reference to representations made by B.E.A.M.A. representatives to the Minister of Fuel and Power about the Herbert Committee's recommendations, the Electricity Bill is outlined. Objections to the clause giving the new Generating Board manufacturing powers have been met since the report was prepared.

Discussions between representatives of the B.E.A.M.A. and the electricity supply authorities are mentioned, the subjects including the Herbert Committee's recommendations with regard to foreign tenders for capital plant and the future of the B.E.P.C. exhibition. Generating engineers have expressed satisfaction with the high figure of plant availability which has been achieved; it reached 94 per cent during the year. Concern was expressed at the cuts in capital expenditure forced by the Government on the electricity supply industry and reference is made to representations on this subject to the Government. Satisfactory results have been achieved in relation to a number of technical and other problems.

Attention is given in the report to the setting up and operation of the Nuclear Energy Trade Associations' Conference which is dealing with such matters as nuclear energy patents, conditions of contract, transport of equipment for nuclear power stations and publicity for nuclear engineering.

In a section on electric traction reference is again made to the railway modernisation plan and to the revival of interest in trolley-buses, stimulated by the Association's propaganda on the subject.

Power Convention Exhibition

Following a review of the proceedings at last year's British Electric Power Convention, the subject of the Convention exhibition is discussed. B.E.A.M.A. has made it clear to the organisers that the C.E.A. and Area Boards should take steps to ensure a greater attendance of potential customers. If experience in 1957 is not favourable consideration will have to be given to holding the exhibition every other year. In any event manufacturers will find it difficult to participate in a 1958 exhibition on account of their commitments in the Brussels World Exhibition.

The Association is preparing a memorandum on the far-reaching economic and technical implications associated with any proposal to change from the Whitworth thread regarding which, it is said, there is much misunderstanding.

Commenting on last year's British Industries Fair, the Council says that the failure of the B.I.F. to provide for the needs of the electrical manufacturing industry has given rise to discussion of the possibility of a future national "all-in" electrical exhibition. It is felt, however, that in the absence of an adequate London exhibition centre the electrical manufacturing industry must continue to spread its efforts over the many exhibitions catering for the individual sections of industry which it serves. In the meantime the Electrical Engineers' Exhibition continues to be well supported by members and informal meetings have been held with the organisers to ensure that everything possible is done to guarantee the continued success of the exhibition.

A tentative proposal for setting up a central testing authority, particularly for domestic appliances, under the auspices of the British Standards Institution has been

considered. Various factors are mentioned as needing careful thought and the matter is left for later report.

The B.E.A.M.A.'s participation in the national inspection scheme for electrical installation contracting is mentioned, and various publicity means and publications are referred to. In this connection it is stated that the fourth edition of the "B.E.A.M.A. Catalogue" is being prepared for publication early in 1958.

Mention is made of the Association's part in several international matters such as engineering contract practices, equipment approval rules, and the International Electrotechnical Commission. One interesting subject referred to is the possibility of collaboration between French and British makers of domestic electrical equipment in view of the proposals for a European common market.

Export Business

A large section of the report is devoted to overseas trade. It is shown that direct electrical exports last year were valued at nearly £273 million—11½ per cent higher than in 1955. This compares with totals of £347 million for the United States and £212 million for Western Germany. It is estimated that with "indirect" exports, i.e. electrical equipment forming part of other engineering goods, the export total approached £300 million.

Electrical machinery accounted for £81·5 million (or 30 per cent) of the total, followed by radio, electronics, telecommunications and valves, £56·1 million; domestic equipment, £38·5 million; cables, £35·4 million; traction, etc., £24·2 million; batteries, £10·3 million; and instruments and meters, £6·9 million. These exports went to over a hundred countries; the Commonwealth took 52·3 per cent, European countries 18·5 per cent, and other countries 29·2 per cent. Figures are reproduced to show that Great Britain's share of total world export trade fell from 28·1 per cent in 1952 to 25 per cent in 1956 while Western Germany's rose from 11·5 to 19·3 per cent. That of the United States remained fairly steady (31·2 per cent in 1952 and 31·6 per cent in 1956).

Handicaps to British export trade are high taxation, purchase tax and restrictive legislation at home, and cut-throat prices, growing local manufacture, anti-dumping measures and new and higher import tariffs.

Hope of eventual relaxation of the restrictions on trade with China is expressed and the question is asked how long margins of preference and favourable tariff arrangements accorded by the Dominions will be maintained. In this connection reference is made to tariff board inquiries in New Zealand, South Africa and Australia.

Adjustments made by Great Britain and certain other countries under the General Agreement on Tariffs and Trade are mentioned and there are references to negotiations with the South African Board of Trade which led to modifications in the application of the Union's anti-dumping measures and also to this country's Dumping and Subsidies Bill.

A number of other matters affecting export trade are dealt with in the report. In a section on competition it is shown that in addition to Western Germany, Eastern Germany, Belgium and Switzerland were strong competitors. Japan's pressure was not so great last year as in previous years because of raw material shortages and the demands of her home market.

A conspectus of views of the Association's Sections on the European Free Trade Area plan has been embodied in a memorandum for submission to the Board of Trade. This shows that in 1956 exports to the six countries concerned in the plan were valued at £26·2 million and imports at only £12 million. It is expected that the removal of United Kingdom tariffs would have a serious effect on home trade, particularly in domestic goods and this, in turn, would affect this country's competitive position in export markets. Fears are also expressed of possible increased activities of the U.S.A. and the U.S.S.R. in Commonwealth markets.

A separate section of the report deals with the 1958 Universal and International Exhibition, Brussels, in which the B.E.A.M.A. is organising a collective exhibit to portray all sections of the British electrical and allied manufacturing industries, with particular emphasis on their overseas contribution to development and progress. Members of the Association who have not yet indicated the extent of their support are asked to communicate with the organising secretary at the B.E.A.M.A. offices.

The activities of the Council Committees are summarised in the next section of the report and the work of the Sections and of the Technical Committees is similarly dealt with in following chapters. The report was to be presented at the annual meeting yesterday (Thursday).

Electric Breakdown in Gases

IN a paper presented before the London Graduate and Student Section of the Institution of Electrical Engineers on 3rd April, Dr. A. E. D. Heylen discussed fundamental qualitative processes underlying quantitative measurements which confirmed the Townsend theory (of 1900) relating to breakdown strength of various gases.

Understanding of breakdown phenomena, he said, had come largely through study of discharges between rounded parallel plates separated by a uniform-field gap of a few millimetres. When a voltage applied to such a field gap was increased to a critical value a spark occurred. This voltage at constant temperature was a function of the product of the gap distance and the gas pressure (Paschen's Law, 1889). In practice atoms in collision did not behave ideally but inelastically and so presented a barrier to the accumulation of energy by electrons moving in the gas under the influence of the applied field.

The conclusion was that the larger the ionisation potential and the inelastic losses the higher would be the value of the breakdown voltage for a particular gap distance and gas pressure. In practice these two requirements of a high electric-strength gas did not go together. The more complex the gas, the larger were the losses incurred by electrons in inelastic collisions, but the lower was the ionisation potential. However, as the electric strength increased with molecular complexity it could be concluded that the strength of gases was mainly determined by the size of the inelastic collision barrier.

Colour Television

INFORMAL talks were given by Mr. L. C. Jesty and Dr. E. L. C. White on colour television on 1st April before the Radio and Telecommunication Section of the Institution of Electrical Engineers. The N.T.S.C. system (National Television System Committee, U.S.A.) the speakers agreed had advantages, when modified to 405- and 625-line standards, over other band-sharing systems. The broad principle of a luminance signal was generally acceptable in the same form as the video signal of a monochrome system, together with a colour sub-carrier modulated in phase and amplitude by colour signals of narrower bandwidth than the luminance signal.

The N.T.S.C. system was, however, open to criticism on three points: colour sub-carrier frequency; detailed make-up of luminance, and colour signals. The greatest task of television engineers of to-day was to devise means of generating, propagating and receiving high quality pictures which would establish without doubt the British lead in the international field in the future.

E.A.W. Conference

New President Appointed

Viscountess Kilmuir, the new president of the E.A.W., addressing the guests at the luncheon. On her right is Mr. C. R. King (chairman, East Midlands Board)

"POWER in a Progressive Community" was the theme of the 32nd annual conference of the Electrical Association for Women which was held in London on Wednesday of last week. Well over 500 members of branches of the Association from all parts of the country, including Scotland and Wales, gathered at the Connaught Rooms during the morning for the annual general meeting over which the Dowager Lady Swaythling (president of the Association) presided. Before the business of the meeting commenced the delegates stood in memory of the late Dame Caroline Haslett, director of the Association since its foundation in 1924 until a few months before her death early this year. Lady Swaythling then paid tribute to the new director, Miss Mary George, and to the chairman, Miss Norah Balls, who had undertaken the office of acting director and with her deep wisdom and understanding had steered the Association through the difficult days after Dame Caroline's resignation.

Presenting the annual report Miss George said that the year 1956 had been one of great change for the Association; it also marked the official opening of their new headquarters at Foubert's Place. The increased requests for E.A.W. material for exhibitions and the varied nature of inquiries that were made showed the public desire for electrical education of a very practical kind. Reviewing the progress of the branches, the report showed that nine new branches were formed. There was an increased membership throughout the Association and several branches now run evening as well as afternoon meetings. The "Planning for Light" campaign provided the predominant feature of all branch programmes and had fulfilled its original aims of spreading appreciation and more detailed knowledge of domestic lighting. Rural electrification, electricity overseas, careers for women in the electrical industry, electricity in industry, social welfare and civic administration were all subjects which engaged the attention of branches.

Miss N. Balls presenting an electric toaster to the retiring president, the Dowager Lady Swaythling. Also in the picture is Mr. David Renton (Parliamentary Secretary, Ministry of Power)

By the end of 1956 the total number of E.A.W. certificates in electrical housecraft awarded to demonstrators and saleswomen was 2,586 and the total awarded to teachers was 2,111. During the year there were 211 successful candidates for the electrical housecraft certificate, while in the teachers' examination 77 were successful. This was an increase of 49 over the 1955 figures, in both cases. The E.A.W. Diploma was awarded to 17 demonstrators, making a total of 504. The number of teachers who hold the Diploma is 94.

With reference to publicity and exhibitions, the report showed that there had been an increase of general publicity and a greater utilisation of the Association's services. Material had been sent to 38 exhibitions compared with 22 in the previous year, including agricultural shows, careers and youth exhibitions, trade shows, etc.

The adoption of the annual report was proposed by Mrs. B. H. Leeson (London Branch) and seconded by Miss G. Lee Stuart (chairman, Aberdeen Branch). Acknowledgment was made of the way in which Miss Balls had carried out her work as chairman, supported by the loyal co-operation of the staff. Later, voting took place for the six vacancies on the National Executive Committee and the following were elected:—Mrs. M. Fraser, M.B.E., Miss N. Kenyon, Miss F. M. Pugh, M.A., C.A., Miss H. Shaw, B.Sc., Mrs. G. A. Tatchell, J.P., and Mrs. A. F. Truman.

Annual Luncheon

The meeting was followed by the annual luncheon and guests included leaders from all branches of the electrical industry. The occasion was taken to announce the resignation of Lady Swaythling as president of the E.A.W.; she is succeeded by Viscountess Kilmuir, D.B.E., who has been president of the Liverpool Branch since 1951. Lady Swaythling, who had been president for 19 years, was presented with an electric toaster by Miss Norah Balls. Following the announcement a short address was given by Lady Kilmuir.

The toast, "Power in a Progressive Community," was then jointly proposed by Lady Rhys-Williams, D.B.E., and Miss Mary Field, O.B.E. Lady Rhys-Williams spoke of the impact of new power sources on home life in rural, industrial and "new town" communities. She said that it was amazing what strides the electrical industry had made in equipping the home. Miss Field gave the professional woman's point of view on the value of education both at home and overseas, and also dealt with

some of the implications of electric power in the domestic life of the territories she had visited. She thought that the next E.A.W. campaign should be for standard sized plugs all over Britain.

The response was made by Mr. David Renton, M.P. (Parliamentary Secretary to the Ministry of Power), who spoke of the Government's power programme. He said that by 1966 25 per cent of all electricity in the United Kingdom would come from nuclear power. The C.E.A. and the South of Scotland Board would spend £3,120 million, of which £750 million would be spent on building 19 nuclear power stations with a total output of between 5,000 and 6,000 MW. Ours was a small and still a beautiful country and power stations were big and not pretty, but if people wanted a better standard of living they must tolerate some power stations and quite a lot of pylons.

Later in the afternoon a reception was held by the English Electric Co. at the Waldorf Hotel, the guests being greeted by Lady Nelson, wife of the chairman of the company. This was followed by a discussion under the chairmanship of Mr. H. C. Timewell (manager, Domestic Appliance Division, English Electric Co.) entitled "The Push-button Era—Factory and Home." Mr. E. R. Davies (Electronics Division) traced the progress of automatic control and handling in industry and suggested that some of these techniques could well be applied to the home. Mr. A. M. Parkinson (sales manager, Domestic Appliance Division) accepted the challenge and showed that appliance manufacturers were indeed adopting scientific developments. Thermostats, "Simmerstats," and automatic timers were among the best known examples. E.A.W. members had already contributed much to improved kitchen planning and they could do still more by encouraging architects and housing authorities to provide good-sized kitchens, properly planned as pleasant and efficient workshops in which to use labour-saving devices.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Large Earthing Systems

THE resumé of the paper read by Mr. Humphries at the Institution of Electrical Engineers on "Large Earthing Systems" published in the *Electrical Review* of 29th March indicates that electrical engineers, although familiar with the problems of earthing for safety during fault conditions and lightning surges, are completely unfamiliar with the trouble caused by building large corrosion cells at power stations. When quantities of buried bare copper are coupled to buried steel, be it conduit, pipes, piling or reinforcing, which in turn is probably bonded to cable sheaths and armouring, it is asking for trouble as the copper is the cathode of a large galvanic cell. In a cell of this nature it is the anodic material that corrodes preferentially to the cathodic material, and this means that all metals bonded to the copper will have their normal corrosion rates accelerated very substantially.

This galvanic cell problem can be overcome by suitable design, using different materials which actually can provide cathodic protection for the buried steelwork or cables, or alternatively, the whole system can be put under cathodic protection which again will prevent corrosion damage.

It is considered that in all engineering work where dissimilar metals are employed the effect of the galvanic cells that may occur should be very carefully considered in the design stage as, if ignored, early failures of vital pieces of equipment may occur.

London, S.W.1. R. A. LOWE, A.M.I.E.E., *Chief Engineer,* Cathodic Corrosion Control, Ltd.

Physical Society's Exhibition

IN the *Electrical Review* of 29th March you refer to the Physical Society's Exhibition and to engineers and scientists looking forward to this annual display. In my opinion in recent years it has become a complete waste of time for the great mass of engineers and scientists whose visits all have to be packed into the three-and-a-half days in which the exhibition is open to them. The crowds nowadays are such as to make it impossible for anyone to see anything.

I think it would be greatly advantageous if the exhibition were kept open for at least twice as long, and that an admission charge could well be made to reimburse the Society for the additional expenses involved. It is agreed that the exhibition catalogue is an excellent work and a most useful reference book.

Isleworth. S. A. STRODE.

N.I.C.E.I.C.

IT is only too apparent to anyone who is faced with the problem that the National Inspection Council for Electrical Installation Contracting has bedevilled itself with a title which is so long as to be a considerable handicap in publicity matter. Even the use of the initials alone is cumbersome, and not easily understandable.

It was with some gratification therefore, that yesterday I received a cheque made payable to the "Nice Installation Contractors."

Perhaps we have got something here!

London, S.W.1. W. G. S. THOMPSON, *Chief Executive and Secretary,* N.I.C.E.I.C.

A Question of Fair Trading

IT has come to our notice that builders' merchants are retailing to builders and contractors copper tanks fitted with immersion heaters and thermostats.

In the interests of fair trading, I feel that this matter ought to be investigated. I can well imagine the reaction of any builder we asked to build a house, using bricks or timber supplied by us.

Brentwood, Essex. JOHN R. SEAGER (Registered Electrical Contractor.)

ELECTRICITY BILL

Further Amendments at Report Stage

AFTER an acrimonious debate, in which Labour M.P.s accused the Government of making a humiliating surrender to Conservative back-bench pressure, the Electricity Bill was amended in the House of Commons last week so that the Central Electricity Generating Board's power to manufacture will be limited to purposes of research, development, repair or maintenance.

The House spent two days on the report stage. Mr. Maudling, the Paymaster General, moved the first new Clause dealing with supplies by the Generating Board to the railways for traction. He said it made very little difference to the present system, which was set out in Section 49 of the 1947 Act, but the provisions needed amending in view of the changed constitution of the industry. The new Clause was agreed to.

Maximum Resale Prices

Mr. Renton, Parliamentary Secretary, Ministry of Power, moved a new Clause giving Electricity Boards the power to fix maximum charges at which electricity should be resold, with different maxima for different types of consumers. Complaints of overcharging had come only from the north-west, the south-east and London, he said, and the Government did not feel that it was necessary to oblige every Board to have maximum resale charges. Subsection 4 stated that any excess charge which was obtained, say, from a tenant by a landlord, should be recovered in a court of law by the person who paid the excess charge. The Clause was agreed to.

Moving a new Clause to provide that the Electricity Council should prepare an annual consolidated statement of accounts, Mr. Maudling said it was designed to carry out an undertaking given to the Opposition during the committee stage. The Clause was agreed to.

Mr. Palmer moved a new Clause which stated that, in exercising his powers under Section 7, the Minister should pay regard to developing the industry in relation to a national policy for the efficient use of all primary and secondary forms of energy. He said that with the decentralisation proposed in the Bill there was a danger that separate parts of the industry would go their own way without proper regard for the general interest.

Mr. Maudling maintained that the new Clause was not necessary because the Ministry of Fuel and Power Act, 1945, imposed on the Minister the duty of securing the effective and co-ordinated development of all fuel and power resources. The amendment was negatived by 229 votes to 188.

On Clause 2 Mr. Renton moved an amendment to the provision that the Generating Board could provide bulk supplies " for any persons or body of persons carrying on an electricity undertaking outside Great Britain for distribution or use by that person or body." In committee the words " or use " had been put in, but it had been found that the words " for distribution or use " would be ineffective since anyone outside Great Britain was beyond the control of the House of Commons, and he accordingly moved that the words should be deleted. The amendment also gave to the Generating Board the power, now possessed by the C.E.A., to provide supplies to consumers direct from the grid, subject to the Minister's approval. The amendment was agreed to.

Mr. Maudling moved an amendment to replace the power to manufacture plant by a power to manufacture " anything required by the Generating Board or by an Area Board for the purposes of research or development or for the repair or maintenance of their equipment." He said that although this would restrict the Board's power to manufacture plant to the purposes named, there was an extension because the amendment referred to " anything required."

Sir Frank Soskice said that in committee the Minister had emphatically resisted exactly the amendment which he was moving now. He had said " We must give them the maximum degree of commercial freedom in order that they may work as efficiently as possible and it is very difficult to see how we are to get proper commercial freedom if we do not leave the Board free to manufacture its own equipment."

Mr. Grimond said that if the amendment were accepted the Board could manufacture anything required for research, development, repair or maintenance. It could certainly manufacture a large nuclear research station and it could hire out electrical plant and fittings.

Mr. Palmer contended that it was foolish and wrong, when a public corporation was given a job to do, that it should be confined in the way it should carry out its duties. The amendment was a triumph for Mr. Nabarro and his pressure group.

After further debate Mr. Maudling, in replying, said that the wording of the amendment did not go as wide as had been suggested. It was true that it gave power to manufacture anything for research purposes, but in Parliamentary drafting it was not possible to distinguish between small and big things.

The amendment was carried by 204 votes to 172.

Composition of Electricity Council

An amendment moved by Mr. Renton to increase the number of independent members of the Electricity Council by three was agreed to after a debate which covered some Opposition amendments which sought to increase the number by six.

Mr. Greville Howard moved that the Minister should appoint one of the chairmen of the Consultative Councils to serve on the Electricity Council, but Mr. Renton said that the Government could not accept the amendment. The local character of consumer representation was brought to bear on the work of the industry through the chairmen of the Consultative Councils being part-time members of the Area Boards. Consultative Councils could also make representations to the Electricity Council. The amendment was negatived.

On Clause 7 Sir Frank Soskice moved an amendment designed, he said, to secure more uniformity on a national basis of the development of the electricity industry. As the Clause stood, when questions arose of reorganisation on a capital basis each Board had to draw up a programme. The Opposition proposed that it should be the Minister who would initiate and carry through a general plan for substantial capital reorganisation.

The amendment was negatived, Mr. Maudling saying that the Government believed in the maximum devolution.

A series of amendments, moved by Mr. Renton,

requiring the Electricity Council to include in its report to the Minister a general review of the activities and progress in England and Wales of the industry as a whole were agreed to.

On Clause 10 a Government amendment to ensure that the existing machinery for joint consultation should continue on a national basis and not be broken down into areas, as was originally proposed, was agreed to.

On Clause 12 Mr. Renton moved an amendment to enable consumers to make representations about special agreements under Section 37 (7) of the 1947 Act to the Electricity Council, but requiring that they should first refer the matter to the Consultative Council for the Area. He said that if a consumer to whom an Area Board refused a special agreement, or offered one on unacceptable terms, was given the right to go direct to the Council it might be concerned with too many ill-considered complaints. The amendment was agreed to.

Stock Issues

On Clause 13 Mr. Fort moved an amendment to permit the Generating Board or any Area Board, with the consent of the Minister and with Treasury approval, to borrow money by the issue of electricity stock for meeting expenditure in connection with works, the provision of working capital, and the repayment of money borrowed. This was discussed with several related amendments in the name of Mr. Fort and other Conservative members, and with a group of Government amendments proposing alternative financial provisions.

Mr. Maudling said the present position, which was continued under the Bill as it stood, was that the Central Authority and the individual Boards could borrow for temporary purposes with the consent of the Minister and with Treasury approval. All other borrowing for genuine capital purposes was to be done by the Electricity Council by the issue of British electricity stock, and it was provided in the Bill that the Treasury might guarantee the issue of such stock as to principal and interest. This was a permissive and not a mandatory guarantee, and there was nothing in the Bill to prevent the Government allowing the Electricity Council to go to the market without a Treasury guarantee, should it wish to do so. The Government amendments on the paper relating to this point would give the individual Boards power, if they wished, and with the consent of the Minister and the approval of the Treasury, to make issues of stock on the market. There would be no question of a Treasury guarantee applying to these issues, because under Clause 15 of the Bill the guarantee could apply only to the stock issued by the Electricity Council.

The group of amendments in the name of Conservative Members sought to abolish Treasury guarantee for the issues from now onward, but at the present moment it was not practicable to place on the market, without Government underwriting, issues of the size involved in the electricity issues.

The Government amendments were agreed to.

On Clause 25 Mr. Renton moved an amendment designed to bring the employees of Area Boards within the purview of the regulations which might be made under subsection (2) of the Clause. That subsection governed the compensation which was payable to officers in the industry who might be adversely affected in consequence of the Bill in the same way as employees of the Central Authority. The amendment was in pursuance of a request made by the Opposition during the committee stage. The amendment was agreed to.

Mr. Renton moved two amendments to provide that the verdicts of referees when deciding upon compensation to officers for loss of office should be subject to appeal to the High Court on case stated, if erroneous in point of law. The second point covered was that, when there was an appeal from the decision from the High Court to the Court of Appeal, that should not be the end of the matter, but there might be a further appeal to the House of Lords, also on a point of law, provided that either the Court of Appeal or the House of Lords gave leave to appeal in the usual way. These amendments had been put down in pursuance of a request by the Opposition. The amendments were agreed to.

On Clause 28 Mr. Maudling moved an amendment to extend from 24 hours to 28 days the period of notice the electricity authority would have to give before entering land for the purposes of exploration. He said the amendment was designed to meet anxieties expressed on both sides of the House in regard to new powers provided for compulsory entry for purposes of survey and, where necessary, sinking boreholes. He emphasised that these compulsory powers would be used only where voluntary negotiations failed.

Mr. Nabarro said that as the Bill still had to go to the House of Lords he would ask the Minister to consider the possibility of an aggrieved person being allowed, if he so wished, to have an independent hearing in certain circumstances.

The amendment was agreed to, and this concluded the report stage of the Bill.

Third Reading

Mr. David Renton then moved the third reading. He said the Minister of Power would make appointments to the Generating Board and the Electricity Council soon after the Bill received the Royal Assent, and the Council and the Board would then have to start their negotiations with the Central Electricity Authority to decide how the Authority's assets and liabilities were to be distributed between the Council and the Board. If the parties failed to agree by 1st November it would then be for the Minister to decide how this was to be done, though there was no reason why they should not agree.

The main structure of the industry would be as originally proposed in the Bill. They had held to the essential character of the Electricity Council, which would be consultative and would advise both the Boards and the Minister. Perhaps the most vital clause was Clause 11 which conferred the duty upon each Board to pay its own way, taking one year with another. The Government did not consider that this would have an adverse effect upon the completion of the rural electrification programme announced in 1953, and they had no doubt that the programme would be completed.

Mr. Palmer said there were practical justifications for the Bill. Both sides had been united about the centralisation of certain things. For instance, in respect of generation of bulk transmission and the wholesale side of the industry. Again, both sides had been united about the need for decentralising distribution. The differences had arisen mainly over financial control.

Mr. Herbert Morrison said his bias was also for decentralisation. There were some things in the Bill the Opposition did not like. They did not like the limitation put on the use of manufacturing powers.

After replying to various points raised in the debate Mr. Maudling concluded by paying tribute to the work which had been done and was still being done by the Central Authority under the remarkable leadership of Lord Citrine, with the full support of the industry.

The Bill was read the third time, and now goes to the House of Lords.

Illuminating Engineering Society

THE annual dinner of the Illuminating Engineering Society was held on 2nd April with the president, Dr. W. E. Harper, in the chair. Proposing the toast of "The Illuminating Engineering Society," Mr. Richard Fort, M.P., outlined the work of the Parliamentary Scientific Committee, of which he is chairman. This Committee, he said, which was founded about twenty years ago, was a unique organisation in that its members were drawn from all parties and were concerned only with the advancement of scientific objects, and avoidance of waste of money in doing so.

Response was made by the president, who referred to the recent proposal to alter the name of the Society, which had not proved acceptable to the majority of members. The adverse vote should not be misinterpreted, as other resolutions relating to changes in the Society's constitution in favour of a broadening and strengthening of its activities had met with full agreement. These included a study of new research projects in universities and technical colleges and the introduction of diplomas in lighting engineering (reported in the *Electrical Review* of 8th March and 5th April). The future offered great opportunities under the leadership of Mr. E. B. Sawyer next year and of his successors in later years.

The toast of the guests was proposed by Mr. A. G. Higgins, who submitted that the importance of the work of the Parliamentary Scientific Committee could not be overestimated. Likewise, he suggested, scientists and engineers should be kept informed of what was being considered by policy makers. He gratefully acknowledged the help received from other organisations in an atmosphere as free as possible from commercial considerations. Responding Dr. H. W. Melville, F.R.S., secretary to the Department of Scientific and Industrial Research, emphasised the need for close collaboration between Government Departments and technologists as providing the best possible way of fostering scientific and engineering developments.

1. Dr. W. E. Harper (the President) and Mrs. Harper receiving Mr. and Mrs. H. Scott. 2. Dr. H. W. Melville, Mrs. Melville, Dr. Harper, Mrs. Harper and Mr. R. Fort. 3. Miss Sawyer, Mr. E. B. Sawyer and Mr. A. G. Higgins. 4. Mrs. Dale, Mr. J. G. Holmes and Mr. V. W. Dale. 5. Mrs. Souter, Mr. E. C. Lennox and Mrs. Barrington. 6. Mrs. Pocock, Mr. J. G. Christopher, Mrs. Holmes and Mr. H. S. Pocock. 7. Mrs. Carpenter, Mr. J. G. Holmes, Mrs. Christopher and Mr. H. Carpenter

INDUSTRIAL NEWS

Electrical Power Convention

Representatives of the trade and technical press had an opportunity last Friday of meeting Sir Josiah Eccles, this year's president of the British Electrical Power Convention, to be held at Eastbourne from 17th to 21st June, the theme being "Electricity in the National Economy." The president was introduced by Mr. J. I. Bernard who was making his first public appearance since his appointment as director and secretary of the British Electrical Development Association at the beginning of the month. He outlined Sir Josiah's distinguished career and mentioned that 39 electrical organisations were represented in the Convention.

Sir Josiah Eccles said that the Convention was not only an occasion for the exchange of technological information, it was an opportunity for letting people at home and overseas know what the electrical industry was achieving. The president emphasised the important contribution which the electrical manufacturing industry was making to export trade and said that there was also a need for a sound home market as an economic base for exports.

Sir Josiah then detailed the programme of papers (given in our 8th February issue, p. 239) and their authors some of whom were present and "took a bow" as their names were mentioned.

There will be 32,000 sq ft of space for the exhibition in Devonshire Park, the stands themselves occupying about 20,000 sq ft. Seventy manufacturers are participating and the South Eastern Electricity Board is arranging a special feature—"Seeboard's At Home."

Power Dispute

The Board of Arbitration appointed by the Minister of Labour under the Industrial Courts Act, 1919, to determine a difference between the Electrical Power Engineers' Association and the Central Electricity Authority, has now been constituted. The members are as follows:—Mr. G. G. Honeyman, C.B.E., Q.C. (chairman), Sir John Green, J.P., and Sir Andrew MacTaggart (employers' representatives), nominees of the C.E.A., and Mr. D. Houghton, M.P., and Professor G. H. Rawcliffe, M.A., D.Sc., M.I.E.E. (workpeople's representatives), nominees of the E.P.E.A. The Board will hold its first hearing on 17th April.

Radiological Protection Course

The fourth short course in radiological protection will be held at the Atomic Energy Research Establishment, Harwell, from 29th April to 3rd May inclusive. The course consists of lectures, demonstrations and practical work and is designed to give practical advice of direct use to people engaged in handling radioactive materials. It is expected that those attending the course will be graduates in a science or engineering subject and should have some knowledge of the principal facts concerning radioactivity. Inquiries should be addressed to the Isotope School, Atomic Energy Research Establishment, Harwell, nr. Didcot.

Electricians' Wage Increase

The National Joint Industrial Council for the Electrical Contracting Industry has granted a wage increase of 2½d per hour for journeymen electricians, with pro rata increases for other grades. The new rates come into operation on Monday, 29th April. The new journeymen's rates per hour will be: Grade "A" Area 5s; Merseyside 4s 10d and Grade "B" Area 4s 7d. Adult mates' pay will be 4s 1¾d, 4s 0¼d and 3s 9¾d, respectively.

Television Transmitters for Denmark

The Danish Posts and Telegraphs Department has ordered transmitting and aerial equipment to a value of £90,000 from Marconi's Wireless Telegraph Co., Ltd., for three new television stations which are shortly to be built at Aalborg, Vestjylland and Naestved. The order includes monitoring and test equipment and flying spot slide scanning units.

Electronics Display Centre

The latest developments from the Mullard research laboratories can now be seen at their new building in Torrington Place, London. At the opening of the centre on Wednesday of last week the managing director, Mr. S. S. Ericks, O.B.E., explained that its purpose was not only to serve as a shop window for Mullard products but also to function as a central source of information. His speech was followed by the unveiling of Barbara Hepworth's sculpture "Theme on Electronics" by Sir Gordon Russell, C.B.E., M.C., director of the Council of Industrial Design.

Apart from the very wide range of products on view, the company showed a film which outlined the need for and the development of an electronic particle counting device. The completed apparatus is known as a film scanning particle analyser and has valuable applications in many branches of science and industry.

Line of display cases at the Mullard Electronics Centre

Switchgear and Circuit-Breakers for British Railways

The British Thomson-Houston Co., Ltd., has received contracts valued at nearly £1,000,000 from the British Transport Commission covering switchgear and high-speed circuit-breakers required for the electrification of the Kent Coast lines of the Southern Region of British Railways. The equipments will be installed in thirty-one substations in the East Kent area. The switchgear includes 111 33 kV, 750 MVA Class MF.36 metal-clad equipments similar to those supplied for the Southern Region change of frequency scheme from 1953 to 1957. The high-speed circuit-breakers, of which there are 316, are truck-mounted (type RJR) and will be installed in the thirty-one substations and in thirty-three track paralleling huts.

Birlec Equipment for Australia

Among the latest exports to Australia is a special camshaft hardening machine made by Birlec, Ltd., Birmingham, for the Austin Motor Co. This machine, which operates by induction heating, is designed to harden the wearing surfaces of journals, cams, eccentric and gear to a depth of 0·05in and to through harden the teeth of the gear. It has an output of twenty-five pieces an hour.

Crypto's New Premises

The rebuilding of the head office and works on the North Circular Road of Crypto, Ltd., a company in the Lancashire Dynamo Group,

Part of the showroom at the new Crypto premises on the North Circular Road

which manufactures food preparing machinery, has now been completed. An additional 50 per cent of floor area has been secured by these alterations which will enable the company to meet the demands that have been taxing the resources of the original works for a long time. During the process of rebuilding, a larger and well-equipped canteen has been provided and a new showroom in contemporary style has been constructed in which the entire range of the company's products is on permanent exhibition.

Football Ground Floodlighting

West Bromwich Albion Football Club has placed a contract with the Midlands Electricity Board for the installation of floodlights at its ground, The Hawthorns, West Bromwich, Staffs. The installation has been planned by a Birmingham firm of consultants, E. McKie and Partners. On each of four towers at the corners of the ground there will be 30 1,500 W lamps. One of the towers, on land sloping away at the Smethwick end of the ground, will be 120ft high, and the other three towers 100ft high. New amenity lighting of stands, etc., is also being installed. The work is to be carried out by the staff of the West Bromwich District of the M.E.B. and is expected to be completed in time for the start of the 1957-8 football season.

Emergency Supply for Signals

Power for signalling on the new Shenfield-Chelmsford-Southend electrification scheme comes from transformers at the traction substations. To meet any failure of this supply a stand-by alternator set has been installed at Ramsden Bellhouse, near Billericay. The set was built by A. C. Morrison (Engineers), Ltd., and is designed to provide an alternative supply if the mains supply voltage and/or frequency vary outside prescribed limits for periods adjustable from zero to 5 seconds. The starting of the plant and change-over of load is entirely automatic, but shut-down and restoration of the load to mains is carried out manually by push-button control.

The set consists of a Ruston & Hornsby 3YC 35 b.h.p. 1,500 r.p.m. diesel engine, flexibly coupled to a 650 V 50 c/s Higgs alternator, both machines being mounted on a common fabricated steel baseplate.

The first phase of the modification scheme, the section between Shenfield and Chelmsford, has an identical automatic set at Hylands, near Chelmsford. These self-contained sets are unattended until they go into service under emergency conditions and are housed in compact brick buildings adjacent to the main substations alongside the line.

P.O. Engineers' Pay Claim

A claim for a 5 per cent pay increase for 70,000 Post Office engineers has been submitted to the Post Office by the Post Office Engineering Union. At the same time the Union has emphasised that it is prepared to discuss any ways of increasing output and efficiency. The claim represents increases from 8s 6d to 12s 6d per week according to grade. The present maximum provincial rates are: Labourers 152s 6d; skilled craftsmen 194s; and technical staff up to £640 a year. London rates are slightly higher. In addition to the engineering and motor transport staff throughout Great Britain and Northern Ireland the claim also covers factories and supplies staffs in London, Birmingham, Edinburgh and Cwmcarn, South Wales.

Irish Electricity Workers Wage Increase

An award of 2½d an hour to more than 2,000 manual workers employed by the Northern Ireland Electricity Board and the Belfast and Londonderry Corporations has been made by the Joint Industrial Council for the electricity supply industry. The increase is retrospective to 1st April.

Architects and Trade Literature

Trade and technical literature produced for the information of architects is the subject of a competition sponsored jointly by the Royal Institute of British Architects and the Building Centre. The competition covers literature, other than space and "prestige" advertising, which is directed to the architect by manufacturers or merchants of building materials and equipment, by their associations or by any other body.

Adjudication will be by a jury nominated by the president of the R.I.B.A., and particulars can be obtained from the Building Centre, 26, Store Street, London, W.C.1.

A.S.E.E. Year Book

The 1956-57 Year Book of the Association of Supervising Electrical Engineers is a much larger edition mainly on account of the expansion of the technical section which constitutes about two-thirds of the Year Book. The section has a wide range—from overhead lines to lighting fittings—and takes in a number of the latest developments.

For the rest the Year Book contains particulars of the Association's constitution, objects and activities, including a list of branches and officers, and other information of use to members.

Works Visit

The Lord Mayor of Cardiff, Alderman D. T. Williams, recently visited the works of South Wales Switchgear, Ltd., Blackwood, Mon., to plant a flowering cherry tree. The avenue

The Lord Mayor of Cardiff (right) with Mr. A. J. Nicholas, the managing director of South Wales Switchgear, Ltd., at the company's works

between the main road and the works is part of the company's property and is to be a cherry blossom avenue. The planting of the first tree by the Lord Mayor on 26th March was followed by a luncheon in the assembly room of the new factory. The guests included Councillor J. Adams, chairman of the Mynyddislwyn Urban District Council.

Lighting Fittings Factory

The new factory recently opened by Electric Depôt, Ltd., at Rugeley, Staffs., is now in full production. The company manufactures industrial local lighting fittings, cable racks and hangers and other equipment. The new works house the lighting fittings division, giving increased facilities at the company's Birmingham works for the manufacture of cable racks, hangers and special apparatus. The new premises are designed and arranged on modern lines and fitted

Part of the new Rugeley factory of Electric Depôt, Ltd.

with the most up-to-date equipment. At an early stage in the planning it was decided to install electric floor heating and the electrical contractors, E. J. Wilcock, Ltd., of Birmingham, were asked to design the electrical installation for a total of 108 kW of heating and approximately 150 kVA of lighting, power and welding load, bearing in mind provision for future extensions to the building. The commercial offices of the company remain at Pritchett Street, Birmingham, 6.

Cannon Street Signal Box Destroyed

On 5th April a fire broke out in the power-operated signal box at Cannon Street Station, London, and it was totally destroyed. All train services into the station were suspended and British Railways said that the signal box could not be replaced for several months. This week it was found possible to work some electric trains into the station but all steam trains were being diverted to Charing Cross and Victoria.

Tyre Factory for Russia

A consortium of British companies has secured a contract from the Soviet Union for equipment for a tyre factory said to be worth "many millions of pounds." Among the members of the consortium is Crompton Parkinson, Ltd., whose sales director, Mr. J. B. Scott, was a member of a party which negotiated the contract in Moscow last week.

Plant for Singapore

The Associated British Engineering Group announces that a member company, Free Piston Engine Co., Ltd., has been awarded a £1,500,000 contract by the Singapore City Council to supply machinery for the Council's St. James electric generating station, Singapore City.

Metropolitan-Vickers' Recruitment of Graduates

Last week was an "open week" at the Trafford Park Works of Metropolitan-Vickers when over 140 potential graduates from twenty-three colleges and universities throughout the British Isles visited the works.

These "graduates" had been interviewed earlier in the year in connection with the company's graduate training courses, when senior members of the company's staff visited their colleges. During last week they were given an opportunity of seeing for themselves the training and career opportunities presented by Metropolitan-Vickers, and of discussing points of interest with training supervisors, and details of the company's post-graduate engineering courses.

British Exhibits in Milan

Several examples of British kitchen electrical equipment, radio and television sets, and lighting fittings are included in a display selected by the Council of Industrial Design included in the Board of Trade exhibits at the International Samples Fair, Milan (12th to 27th April).

Engineering Exhibition

There will be over 500 exhibitors at the Engineering, Marine, Welding and Nuclear Energy Exhibition which will be held at Olympia, London, from 29th August to 12th September next.

"Transport Age"

We have received a copy of the first issue of "Transport Age," a British Transport Commission new quarterly publication which sets out to form a link between the British Transport system and the industries it serves. It will be primarily concerned with freight services. An article in the first issue shows how rail transit times will be cut by the mechanisation of marshalling yards and gives emphasis to the railway modernisation plan.

Trade Announcements

Mr. C. M. Fraser has been appointed sales representative with the Ferguson division of **Thorn Electrical Industries, Ltd.**, and will cover a new area comprising North Riding and the northern part of West Riding, Yorks. His address is 4, Brantford Street, Leeds, 7. Mr. R. Hardwick, who has covered the whole of Yorkshire for several years, will continue to represent Ferguson in East Riding, the southern part of Yorkshire and the northern areas of Notts., Lincs. and Derby previously covered by Mr. S. G. Baxter, who will be responsible for the remainder of these counties. Mr. J. Mathers will add the counties of Merioneth and Montgomery to his existing area of North Wales, Cheshire, Salop and Staffordshire. Mr. D. H. Jacob will succeed Mr. Fraser as assistant to the northern area manager.

Ever-Ready Razor Products, Ltd., has acquired financial control of **Arvin Electric, Ltd.**, Southend-on-Sea, manufacturers of electric dry shavers. Both companies will retain their separate identities. Arvin will continue to produce electric shavers, concentrating sales and distribution through the electrical and radio outlets. Ever-Ready Razor Products, Ltd., has recently moved its executive office to 26-28, Bedford Row, London, W.C.1.

Winston Rentals, Ltd., has been formed under the chairmanship and managing directorship of Mr. F. Winston Reynolds, chairman and managing director of **Winston Electronics, Ltd.**, to deal with the newly instituted rental, hire purchase and credit purchase schemes for the radio-operated "WinstoNeon" sign. The address of the new company is the same as for Winston Electronics, Ltd. —Shepperton, Middx. (telephone: Walton-on-Thames 6321).

Mr. F. L. Harding has joined **Pamphonic Reproducers, Ltd.**, as representative in the southern counties, based on Portsmouth area, and Mr. J. S. Thompson has been appointed representative in the Midlands area, based on Nottingham.

E. N. Bray, Ltd., have outgrown their present factory at Walthamstow which they have occupied for some 30 years and are moving to a new and larger factory at Control Gear Works, Britannia Road, Waltham Cross, Herts. They will be operating from the new address as from Monday next, and the official opening ceremony will take place on Wednesday.

Mr. D. J. Burnett has been appointed technical sales representative of the Thermovent heating division of E. K. Cole, Ltd., covering the South London area. He joins E. K. Cole, Ltd., from the domestic appliance division of Ferranti, Ltd. Mr. Burnett is at the London office, 5, Vigo Street, London, W.1 (telephone: Regent 7030).

Castelco (Great Britain), Ltd., Old Woking, has appointed Leonard and Graham Wright, Hampton-in-Arden, Warwicks., as its representatives in the Midlands in succession to the late Mr. J. H. Wilson-Browne.

Giles (Electrical Engineers), Ltd., have moved their head office to 37-41, Bedford Row, London, W.C.1 (telephone: Chancery 2848).

Advertisement Correction

The address of Tok Electrical and Industrial Mechanisms, Ltd., given in the company's advertisement in our last issue was incorrect. The company is at 17, Bury Street, London, E.C.3 (telephone: Avenue 5035).

E.D.A. Sales Conference

Opportunities for Load Development

SALES staffs from all the Area Electricity Boards have been attending the twentieth E.D.A. Sales Conference which opened on Tuesday last at the Caxton Hall, Westminster. Lord Chandos (president of the Association) opened the proceedings and Mr. D. Bellamy, O.B.E. (chairman of the E.D.A. Council and chairman, Yorkshire Electricity Board) was in the chair.

Following the address by Lord Chandos, Mr. Bellamy presented his paper "The Domestic Consumer," which he gave at last year's British Electrical Power Convention.

Selling the Electric Cooker

Cooker load prospects were critically examined in a paper contributed by Mr. T. E. Daniel, M.Eng., M.I.E.E., M.I.Mech.E., chairman of the North Western Electricity Board, on Tuesday afternoon, when Mr. D. Bellamy presided.

Introducing his subject, Mr. Daniel said that the purpose of the paper was "to confirm our conviction that electric cooking is a good thing for the consumer and a desirable load for the Boards." He referred to the national sampling survey of 1955 which showed that the cooker "saturation" was 24·5 per cent, or in other words that 75·5 per cent of domestic consumers had yet to be converted to electric cooking. With nearly 13 million domestic consumers in this country this meant that there were nearly 10 million without electric cookers. The most satisfactory group was the middle class with a saturation of 37·95 per cent; then followed the well-to-do with 24·14 per cent, the working classes with 17·29 per cent and the lowest income group (pensioners, etc.) with 7·09 per cent.

Turning to the question of ascertaining consumer preference, he said that the two main methods were scrutiny of experience on new estates and public opinion polls, though he admitted that it was almost impossible to free either source from weighting or bias. It was clear, however, that people did not necessarily "choose" the methods of cooking they used. Thus of the 15,000 people who recently answered a questionnaire for the B.B.C. Woman's Hour Programme, 50 per cent stated that they preferred electricity for cooking and water heating while 26·5 per cent preferred gas and 23·5 per cent chose solid fuel. A subsequent poll in which cooking and water heating were separated gave the following percentage preferences: Cooking—Gas 47, electricity 44, solid fuel 8 and oil 1. Water heating—Electricity 57, solid fuel 32 and gas 11.

The policy of freedom of choice had been accepted for a long time in Government circles and by the more enlightened local authorities, though there were still a few who took the short-sighted view that the initial cost was all that mattered. Even with freedom of choice, however, it must be considered whether consumers in the smallest-income group and those who had to move home from time to time would be able to cook by electricity in the absence of simple hire facilities. Had the cessation of simple hire resulted in electric cooking losing ground?

Dealing with cooker design, he said that the oven was no longer a real problem for the salesman but the hob equipment was not quite so easy. Did we really need two sizes of hotplate? Would it not be better to offer three hotplates of a standard size, say 7in? One advantage would be that we should have a size similar to that used on the Continent and could take advantage of developments there. In America 12½ per cent of electric cookers sold in 1955 were built-in types. Such cookers provided a more secure load and the method was more easily carried out by electricity than by gas. The fact must be faced that the cost of maintaining electric cookers could be a serious brake on development. The multitude of switch knobs, the non-interchangeable thermostats and other parts tended to keep maintenance costs higher than they should be.

Mr. Daniel next dealt with Boards' selling methods and referred to the American electrical industry's successful "Live Better—Electrically" campaign. He also touched upon the role of electrical contractors and retailers. In conclusion he acknowledged the assistance received from Mr. A. O. Johnson and his staff in the preparation of the paper.

Domestic Water Heating

Both morning and afternoon sessions on Wednesday were devoted to a four-part paper on "Developing the Domestic Water Heating Load." Mr. W. A. Gallon, B.Sc., M.I.E.E. (deputy chairman, South Wales Electricity Board), presided.

In the first part, "The Potential Field," Mr. E. H. Skinner, M.I.E.E. (chief commercial officer, South Eastern Electricity Board), said that the opportunity for development had never been greater. He considered the commonest types of water heating appliances in turn, namely, the immersion heater, the sink water heater, the large storage water heater and the wash boiler. On the sink water heater, he said the opinion was growing that the 1½ gal size was too small and that it should be increased to 2 or even 3 gal. A point for consideration was whether tenants might not be reluctant to buy sink water heaters for fear of having to leave them behind should they move. Would it be possible to design a less permanent connection to the water supply?

The C.E.A. Utilisation Research Committee's 1955 survey showed that 192,000 consumers were then using large type electric storage heaters, a low figure which was being rapidly improved upon as a result of the popularity of the "two-in-one" heater. A recent estimate put the present total of large storage heaters on circuit at over 250,000 of which about 70,000 were "two-in-one" heaters. More rapid progress might be made if apparatus less costly than the factory-built storage heater were used. An immersion heater fitted into an adequately lagged standard cylinder should give satisfactory service.

Pessimistic views had been expressed about the future of the wash boiler, possibly because of the remarkable progress of the washing machine, but figures available did not support such pessimism. Sales at present were in the region of 150,000 per annum.

On the subject of cost, Mr. Skinner said that Dr. J. C. Weston, of the Building Research Station, as the result of research at the Abbots Langley experimental houses in 1949, had concluded that with electricity at 0·75d/kWh, gas at 12d/therm and coke at £4 10s/ton, the cost of providing 200 to 250 gallons of hot water a week in summer was likely to be in the region of 3s to 4s.

Adjusting these figures to the present 1·1d " unit " charge in S.E. England, the comparable price for gas would be 17½d/therm and for coke £6 12s/ton. In fact, the average gas price in S.E. England was 23d/therm and the price of coke was £9/ton.

The second section of the paper was by Mr. E. M. Ackery, B.Sc. (E.D.A.), who contended that from the point of view of load factor improvement the domestic water heating load was almost ideal. There was no physical reason why the demand should not be met entirely by off-peak electricity, though whether it would be an economic proposition was debatable. Among the many ways which had been suggested for load factor improvement the following were worth looking into in some detail:—To ensure that all installations were efficiently designed and lagged so that users could be persuaded to leave them switched on continuously; to use immersion heaters of relatively low loading; to modify straightforward thermostatic control to ensure that storage capacity was used for load factor improvement; to keep the load off-peak by remote control or by time-switch control; to divide the load and keep the greater part off-peak; to charge a fixed sum for the water heating service; and to use an immersion heater in winter as a booster to a solid fuel fired system. Each of these methods was considered in turn by the author.

A manufacturer's point of view was given by Mr. R. E. McInnes, A.M.I.E.E., representing the Water Heater Section of the B.E.A.M.A. Having reviewed the various systems and discussed comparative running costs, he said that a large section of the public was unaware of the change in relative costs of electricity and other fuels. Water heating by electricity had in fact become the cheapest convenient method for domestic use. Once the facts about the new cheapness of electricity were adequately publicised and their truth had become universally accepted by the public there would be a tremendous increase in the demand for electric water heating appliances. This stage could be reached within a few years.

In the final section of the paper, on " Selling Constant Hot Water," Mr. L. Shepherd, B.Sc.(Eng.), M.I.E.E. (Eastern Electricity Board), devoted particular attention to lagging, giving the standing losses with different types and thicknesses. In the case of a cylinder of 30 gal nominal capacity, the losses for a 70 deg F water/air temperature difference ranged from 8·5 kWh a day for the bare vessel to 1·2 kWh with 4in thick " Fibreglass." With ½in thick lagging of this type there was a 64 per cent saving in standing losses as compared with the bare cylinder; with 1in, 76 per cent; 2in, 83 per cent; 3in, 86 per cent; and 4in 87 per cent. Clearly there was a limit to the amount of insulation that it was worth packing round the storage vessel, but the optimum economic thickness for continuous operation throughout the year was such that there would rarely be space to accommodate it.

Consideration was also given to water heating by gas and solid fuel and costs were compared.

The Home Laundry

Yesterday's proceedings opened with a paper on " The Home Laundry," by Ena M. Eaves (E.D.A.). Mr. D. B. Irving, B.Sc., M.I.E.E. (chairman of the London Electricity Board) was in the chair.

Miss Eaves opened by saying that just as it was important to understand main cooking and refrigeration methods, and the most suitable electrical appliances to achieve the desired results, so it was equally important to understand laundry methods and the most suitable electrical appliances for the particular purpose. The degree of saturation for electric home laundry appliances was low. The market for appliances was therefore varied and wide. Provided the right approach was made many more of these appliances would be sold to every home where there was electricity and in which the housewife dealt with all or part of the family wash. To take one example, the one which, after the electric wash boiler, was most frequently the first to be bought—the electric washing machine—we were a long way from saturation point even though sales of washing machines had been great, and were still continuing steadily. According to a C.E.A. booklet, out of every hundred washing machines sold, only twenty were sold by Area Boards.

The sales drive had now extended far beyond the washing machine, and the stage had now been set for the sale of the complete home laundry. The main consideration was to find the appliance or appliances most suitable for each particular consumer, and this necessitated an appreciation of the widely differing needs represented by the homes all over the country.

Miss Eaves outlined the requirements of the home laundry. She detailed the various methods of heating water electrically, dealt with washing agents, and described the sales appeal of the various types of washing machines, spin and other dryers, and irons, and spoke of the need for demonstrations and production facilities for the demonstrator. In dealing with laundry demonstration appeal she said that perhaps the conventional washing demonstration would never have the immediate appeal to " all sorts and conditions of men," that was made by the cooking demonstration. It might be that a good way, therefore, to put over the home laundry story was by a combined automatic cooking and laundry demonstration. The paper concluded by outlining some sales methods.

Industrial Load Development

Mr. T. Coates, M.Eng., M.I.E.E., M.I.Mech.E. (deputy chairman, North Western Board), was the chairman at the afternoon session when Messrs. N. Axford, B.Sc., M.I.E.E., and F. A. Hitchcock, A.M.I.E.E., presented a paper on " Industrial Load Development from a District Point of View."

The authors stated that in the year 1955-56 Area Boards sold 32,431 million kWh to 172,492 industrial consumers. Even assuming an average load factor as low as 20 per cent, this represented an average maximum demand of 108 kW. Much had been said about the need for increased productivity and there was no doubt that this increase could best be met by the use of electricity. Yet the number of kWh sold for industrial purposes expressed as a percentage of the total output of public supplies had remained practically constant over the past twenty years. During the past two or three years there had been a very considerable increase in the planned development of the domestic, farming and commercial load, but the economy of electricity supply depended upon a co-ordinated distribution system in which all classes of load were developed concurrently. The development of the industrial load should be approached with the same vigour as was applied to the rest of consumers.

It was essential that managements who were planning projects now should have inculcated into them the advantages of adopting electrical methods at this stage so that they were in a position to use the electrical methods of the future. Such an attitude must be cultivated and the senior staff already established in a District provided a means whereby this information could be made available to all consumers. With their engineering background and training they were in a position to appreciate new techniques.

All development work must start from a proper system

of tariffs which must be incentive in form to encourage the consumer to increase his use of electricity; improvement of load factor and particularly of night use, must be rewarded.

After the idea of adopting some particular electrical method was implanted it would be necessary to go into the subject in considerably more detail, and it was here that the industrial power engineer came into his own. His was the job of surveying the field and finally making a comprehensive report that gave the consumer a full picture of the project in sufficient detail to enable a decision to be made. Industrial power engineers should be established in appropriate districts and sub-areas, and at the head offices of the Boards.

Turning to contracting the authors said that, in the industrial field particularly, this assisted materially in development, and they advocated the setting up of a contracts organisation; but they also pointed out the great help that could be given by established contractors and suggested that they should be encouraged to have early discussions on any particular project in order that the supply aspect could be thoroughly investigated.

The conference concludes to-day (Friday) with a general discussion and a luncheon.

Infra-Red Radiation

THE FORTY-EIGHTH KELVIN LECTURE

DR. G. B. B. M. SUTHERLAND, F.R.S., who delivered this year's Kelvin Lecture on 4th April at the Institution of Electrical Engineers, began by referring to the work of Sir William Herschel who in 1800 began " an investigation of the powers of the prismatic colours to heat and illuminate objects." Herschel proved the properties of reflection and refraction for invisible heat rays and measured their absorption in glass and liquids.

Gaps in Herschel's results, he said, had now been effectively bridged. The most interesting region in the infra-red was the so-called vibrational infra-red which was associated with the characteristic vibrations of molecules. If Herschel had had a detector of infra-red radiation superior to a mercury thermometer, he could undoubtedly have proved the correctness of his speculation that the heat-making rays " occasioned vibrations in the parts of bodies."

Of the innumerable ways of detecting infra-red radiation, those of practical use were photo-detectors and thermo-detectors. In the photo-detector, the incident photon or quantum of infra-red radiation had an immediately observable effect; by exciting an electron to move from one energy level to another it brought about a change in conductivity, a chemical reaction taking place. The thermo-detector was related to the heating effect. When infra-red radiation was absorbed, the temperature rose. A physical property of the body under investigation could then be used to detect the infra-red radiation. In general, thermo-detectors were sensitive to all wavelengths, whereas photo-detectors usually went only to 10 microns.

He described various types of detectors, pointing out that a photo-detector based on phosphor was used during the war to enable paratroopers to rally round their leader after they had been dropped, their phosphor devices picking out his infra-red source.

In exploring the infra-red field one of the most interesting applications was infra-red spectroscopy. An infra-red spectrum could be produced with a source such as a Nernst filament or globar dispersing element, a prism or a grating detector dispersing the radiation. In general, the most interesting work had been done in the intermediate infra-red region where the characteristic vibrations of molecules appeared. As compared with the spread of one inch covered by Herschel, modern spectrometers spread out over 100 yards effectively.

An important application was the correlation of the infra-red spectrum with structure, which was connected with the modes of vibration. If the molecule vibrated in such a way that an effective dipole moment was produced, there was a corresponding band in the infra-red spectrum and the number of bands indicated the structure of the molecule.

Applications deriving from infra-red spectroscopy included the investigation of the ammonia molecule, water absorption, atmospheric absorption, planetary atmospheres, petroleum analyses, penicillin structure, diamond types and the protein molecule, as well as nucleic acids.

The composition of the atmosphere could be investigated and, more important, the heat balance, the whole of which was controlled by the absorption of heat due to the bands in the infra-red. Had the water molecule been straight instead of bent the climate of the world would have been different. Infra-red analysis could also be used to investigate the gases in the sun and to pick up many gases in the atmosphere of the planets. During the war infra-red analysis made possible a quick and accurate assessment of the petroleum situation in Germany from samples of petroleum from its bombers and fighters.

While the X-ray method first showed which structure was correct for penicillin, the infra-red method provided independent proof and also answered objections raised by certain chemists who favoured other types.

Infra-red analysis had started with simple molecules and had progressed to more complex ones, such as the protein molecule. This was one of the most versatile molecules in nature and provided the material from which muscle, nail, hair, feather, silk and nerve fibre came from. In the last five or six years its configuration had been established, largely by X-ray methods, although infra-red methods had been and would in future be useful.

Apart from protein the most important biological molecule was that of nucleic acids. The so-called desoxyribonucleic (D.N.A.) was the acid in genes. This molecule contained the genetic information passed from one generation to the next. Another form of the molecule was concerned with the synthesis of protein. The information from D.N.A. must be passed on by an electro-mechanism, but it was not known at present how this was done. In a sense, automation seemed to be a crude way of doing what nature did more elegantly by the molecular process. Electrical engineers might have to find out in the future exactly how nature did some of its automation and do it through the molecular process.

In conclusion, he quoted Herschel's prophetic remark: " Lastly on the transmission of invisible terrestrial radiation—the subject which appears most pregnant with useful inferences for the common purposes of life."

DOMESTIC ELECTRICAL EQUIPMENT

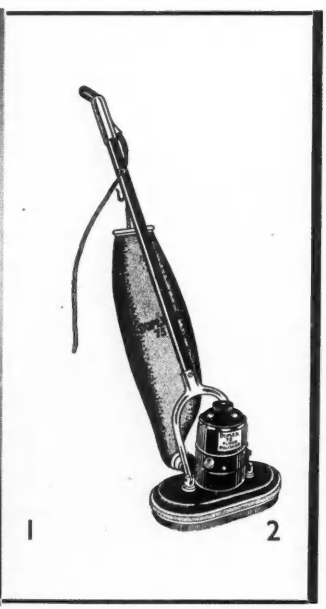
Floor Polishers

FLOOR cleaning and polishing can be a laborious process but with the aid of an electric floor polisher the task is made easy and the work can be done in a tenth of the time taken by hand. Several models also tackle wet scrubbing and can easily be adapted for other purposes such as buffing, sanding, scouring, etc., while suction types eliminate the need for pre-sweeping.

Running costs are almost negligible as the series wound, universal type of motor used in most models is normally rated at not more than ¼ h.p.

Both two- and three-brush polishers are equally popular and prices, on the average, are in the region of £30, including purchase tax. There is, however, a new lightweight model, recently introduced by Ladybird Appliances, Ltd., that costs just under £15, including tax. It is a two-brush polisher and its 8½ lb weight enables it to be easily held in the hand while polishing furniture, etc. The latest development of Electrolux, Ltd., is a polish distribution accessory designed for fitting to their B.9 triple-brush polisher.

Manufacturer	Name or Model	Type	Motor	Weight	Special Features	Finish	Price (excl. tax)	Purchase Tax
BYLOCK ELECTRIC, LTD., 109, South Street, Ponders End, Middlesex.	" 532/3 "	Three brush	325 W	24 lb	Incorporates scrubbers, scourers and polishers	Grey stoved enamel	£16 17 6 £17 8 0 (suppressed)	£7 8 2 £7 13 2 (suppressed)
COLUMBUS-DIXON, LTD., Capitol Works, Empire Way, Wembley.	" Columbus " III	Two brush	400 W	25 lb	Attachments for vacuum cleaning, dusting, drying and scrubbing	Aluminium	£43 15 0	£19 13 9
ELECTRIX, LTD., Sterling Works, Dagenham, Essex.	" Electrix "	Three brush	350 W	13¼ lb	Lightweight, foot-operated switch	Fawn and brown	£16 10 0	£6 8 9
ELECTROLUX, LTD., 153-5, Regent Street, London, W.1.	" B.9 "	Three brush	250 W	19 lb	Triangular body for getting into corners. Quiet action. T.V. suppressed	Maroon and grey hammer-tone enamel	£23 0 0	£10 1 10
	" Turbo Polisher " attachment	Single brush	—	—	For use with " Electrolux 55 " vacuum cleaner	Grey hammer-tone enamel	£7 10 0	£1 12 11
ELECTRONA ELECTRICAL PRODUCTS, LTD., Islington Mill, James Street, Salford, 3.	" Duplex 75 "	Two brush	400 W	23 lb	Air cooling fan	Brilliant hard enamel, chromium and polished aluminium	£21 10 0	£9 6 3



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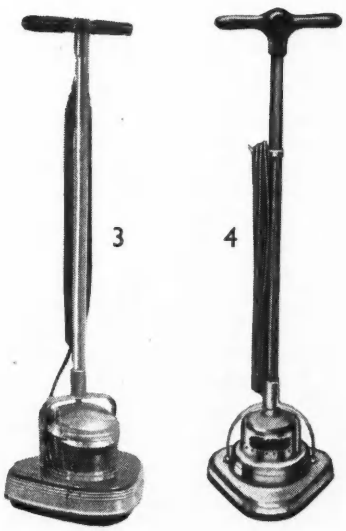
1. *Ladybird Appliances lightweight polisher*
2. *Electrona " Duplex 75 " polisher*
3. *Bylock model 532/3 polisher*
4. *Tellus Super Vacuum Cleaner Co.'s 3-brush polisher*



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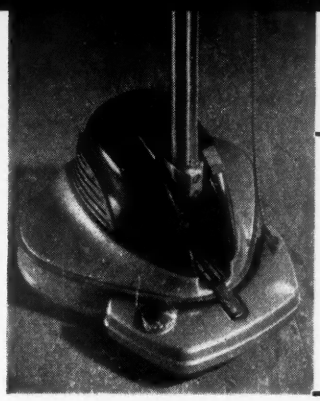

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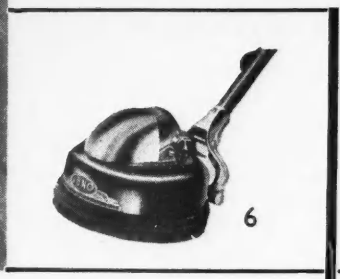

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5. *Electrolux "B.9" polisher fitted with polish distributor*
6. *Truvox "Juno" polisher/scourer*
7. *Hoover polisher and scrubber*
8. *Vactric model F.P.50H 3-brush polisher*
9. *Tricity Cookers model P.3 polisher and scrubber*
10. *G.E.C. DM.342 2-brush polisher*

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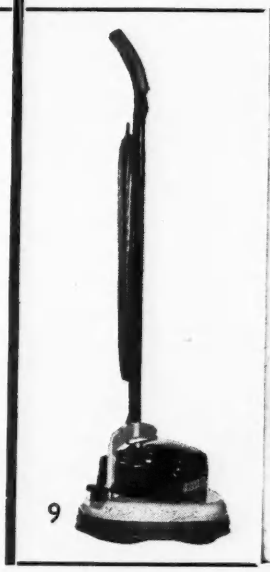

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Manufacturer	Name or Model	Type	Motor	Weight	Special Features	Finish	Price (excl. tax)	Purchase Tax
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.	"DM.342"	Two brush	270 W	15 lb	Double insulated, T.V. suppressed, automatic switching	Grey and maroon	£20 10 0	£9 0 0
HOOVER, LTD., Perivale, Greenford, Middlesex.	"Hoover"	Two brush	225 W	13½ lb	Scrubbing brushes and lambswool pads. Headlight	Maroon enamel, plastic moulding	£21 0 0	£9 9 0
LADYBIRD APPLIANCES, LTD., Emmbrook Mill, Reading Road, Wokingham, Berks.	"Ladybird"	Two brush	250 W	8½ lb	Low priced, suitable for furniture, built-in overload clutch	Cream stoved enamel	£10 10 0	£4 9 0
TELLUS SUPER VACUUM CLEANER, LTD., 39, Sheen Lane, Mortlake, S.W.14.	"Tellus"	Three brush	300 W	24 lb	Quiet action, 2 sets brushes, felt pads	Polished aluminium	£29 11 9	£13 8 3
TRICITY COOKERS, LTD., 109, Kingsway, London, W.C.2.	"S.P.3"	Three brush suction	350 W	17⅜ lb	Triangular head, vacuum bag, headlight. Can be used for wet scrubbing	Grey and maroon stoved enamel	£22 0 0	£9 10 7
	"P.3"	Three brush	310 W	17½ lb	Can be used for wet scrubbing. Fully lowering handle	Grey and maroon stoved enamel	£19 19 0	£8 12 10
TRUVOX, LTD., 15, Lyon Road, Harrow, Middlesex.	"Juno" polisher/ scourer	Single brush	250 W	16½ lb	Revolving inner brush. Polishes, buffs, sands and scours	Chromium or stoved enamel	£18 18 0 (chromium) £17 10 0 (enamelled)	£8 5 11 (chromium) £7 13 8 (enamelled)
VACTRIC, LTD., 196, Sloane Street, London, S.W.1.	"Vactric" F.P.50H	Three brush	340 W	19½ lb	Rapid brush ejector. Interchangeable scrubbing brushes	Gold "Dimenso," maroon accessories	£21 5 0	£8 3 8

GENERATION AND DEVELOPMENT

Power Station Efficiencies

The annual return of power stations of the Central Electricity Authority in respect of thermal efficiency was issued last week. It shows that last year nearly a million tons of coal was saved in the power stations of the C.E.A. in England and Wales by increased efficiency of operation. The overall average thermal efficiency during the twelve months was 24·70 per cent, as compared with 24·14 per cent for the previous year.

Of nearly 75,000 million kWh supplied from these stations over 30 per cent was provided by the 20 most efficient stations operating throughout 1956. These 20 stations had an average efficiency of 28·91 per cent, their individual efficiency percentages being as follows.

Stations	Thermal Efficiency per cent
Littlebrook "B," Dartford, Kent	30·62
Drakelow, Burton	30·54
Stourport "B" L.P., Worcs	30·08
Stourport "B" H.P., Worcs	30·05
Stella South, near Newcastle-upon-Tyne	29·70
Barking "C," London	29·40
Dunston "B" II, Newcastle-upon-Tyne	29·33
Stella North, near Newcastle-upon-Tyne	29·16
Ince, near Ellesmere Port	29·02
Skelton Grange, Leeds	28·81
Keadby, Scunthorpe	28·70
Brunswick Wharf, Poplar	28·68
North Tees "C," Middlesbrough	28·60
Littlebrook "C," Dartford, Kent	28·55
Carrington, near Manchester	28·46
Bromborough, Cheshire	28·44
Brighton "B"	28·36
Battersea "B"	28·30
Deptford East H.P.	28·24
Poole	28·24

Five other stations which did not come into operation until after 1st January, 1956, but nevertheless recorded high efficiencies during the period they were working, were:

Stations	Thermal Efficiency per cent
Portishead "B," near Bristol	30·00
Wakefield "B," Yorks	29·26
Hams Hall "C," near Birmingham	28·91
Meaford "B," Stone, Staffs	28·72
Marchwood, near Southampton	28·38

Ffestiniog Pumped Storage Project

The first major pumped storage power station to be built in the United Kingdom—at Ffestiniog in North Wales—will be equipped by the English Electric Co., Ltd., under a contract just placed by the Central Electricity Authority. The contract covers four 105,000 h.p. water turbines, governors, storage pumps and valves.

Water will be pumped from a lower to an upper reservoir at night when surplus electric power is available to drive the pumps. The stored water will then be used to generate power to satisfy peak demands. The pumps will be installed below the turbines and connected to them by disengageable couplings. The turbines will operate under a maximum head of 1,050ft.

Sulzer Bros. (London), Ltd., in association with Sulzer Bros., Switzerland, are the sub-contractors for the storage pumps, each of which will absorb a maximum of 105,000 h.p. These units will be the largest-output multi-stage vertical shaft storage pumps yet built and will each weigh approximately 292 tons.

All the English Electric work as well as the manufacture of the larger pump components will be carried out at the Netherton Works, Liverpool, about 80 miles from the power station site. The station is due to begin operating in August, 1961.

High Marnham Contract

A contract for the construction of the second stage of the foundations at High Marnham power station, Nottinghamshire, has been awarded by the Central Electricity Authority to Taylor Woodrow Construction, Ltd., who are already engaged on the first stage. Taylor Woodrow's contract now covers the whole of the main foundations and circulating water works for the station's boiler and turbine plant, producing 1,000 MW from five sets. The work, valued in all at £4,250,000, is expected to be completed in the summer of 1961.

C.E.A. Collier in Collision

In fog off the North Foreland on Thursday last week the C.E.A. collier *Sir John Snell* collided with and sank the 940-ton London coaster *Lisbeth M.* The master, the chief engineer and the third engineer of the coaster lost their lives and two other members of the crew are missing.

New Eastern Area Tariffs

Last month the Eastern Electricity Board announced a revision of tariffs to meet increased costs, the principal change so far as domestic consumers were concerned being the raising of the "unit" charge from 1d to 1¼d. Details of the revised tariffs, and of a new week-end rate to cater for the needs of residential homes, hotels, etc., have now been published by the Board. They are to come into force from the first meter readings after 30th June. The new rates are as follows:—

Domestic.—TWO-PART RATE. Quarterly fixed charge of 24s 11d for premises up to 1,200 sq ft, with 4s 4d for each additional 400 sq ft; residences exceeding 4,400 sq ft, 63s 11d. "Unit" charge 1½d.

PREPAYMENT RATE. Weekly fixed charge of 2s 2d—4d—5s 2d in place of the quarterly charges given above.

NIGHT AND DAY RATE. Fixed charge as above plus 13s; "Unit" rate 0·9d between 9 p.m. and 7 a.m. (10 p.m. to 8 a.m. in "Summer Time").

BLOCK RATE. First 130 kWh per quarter, 6d/kWh (prepayment supplies 6½d); 130-1,430 kWh, 1¾d/kWh; in excess, 1½d/kWh.

Combined Premises.—TWO-RATE. Quarterly charge of 71s 6d and appropriate domestic charge. "Unit" rate 1¼d. Night and day and block rates are available similar to those for domestic premises.

Farm.—TWO-RATE. Quarterly fixed charge of 71s 6d per 5 kVA of "farm assessed demand" with charge for residential premises as for domestic two-rate tariff. "Unit" charge 1¾d. Subject to a maximum charge of 6d per kWh supplied.

NIGHT AND DAY RATE. Fixed charge as above plus 13s and a further 13s for each 5 kVA by which the maximum power required exceeds the "day assessed demand."

Block Tariff.—For supplies up to 40 kVA. First block at 6d/kWh; second block at 2¾d/kWh; remainder at 1¾d/kWh. For supplies up to 5 kVA the first block is 182 kWh and second 1,820 kWh, these figures increasing *pro rata* in 5 kVA steps.

NIGHT AND DAY RATE. Similar to farm night and day rate.

WEEK-END RATE. Fixed charge of 19s 6d and a further 19s 6d for each 5 kVA by which the maximum power required exceeds the "day assessed demand." "Unit" charge 0·9d for supplies between 7 p.m. and 7 a.m. (8 p.m. and 8 a.m. in summer), and all day on Saturdays and Sundays.

Maximum Demand Tariff.—Monthly fixed charge per kVA of 2s (l.v.) and 1s 6d (h.v.). Maximum demand charge 13s 6d per kW where the demand is 75 kVA or less, reducing to 9s 3d (l.v.) and 9s (h.v.) for larger supplies. The "unit" charge scale for l.v. supplies is 0·76d/0·54d and for h.v. supplies 0·74d/0·52d, increased or decreased by 0·0007d (l.v.) or 0·00065d (h.v.) for each penny variation in the cost of coal from the basic figure of 60s per ton.

Noise from a Transformer

In our issue of 7th December last we reported a protest which had been made by residents of Enfield against the noise emitted from a transformer belonging to the Eastern Electricity Board. We have now received from one of the residents an account of the discussions with the Electricity Consultative Council.

The local committee of the Council reported that tests made on 15th December at 1.30 a.m. showed that the transformer was particularly quiet in operation. Immediately round the transformer an average reading of 43 dB was obtained, and at 50ft away the transformer was quite inaudible.

To this the residents replied that a test at 1.30 a.m. was invalid as this was the time of minimum load and therefore minimum noise.

The Council said that suggested alternative sites were not suitable for various reasons nor was it technically or economically sound to supply the area by l.v. mains from a distant substation. The conclusion was reached that the noise from the substation could not be regarded as a nuisance at the present time nor was it likely to become so in the future.

North Western Price Increase

The North Western Electricity Board announced on Monday that more than 1,500,000 consumers will pay more for electricity after 1st July. The general increase will be 10 per cent, but there is a concession in the case of places of worship, community halls, etc.

NEW ELECTRICAL EQUIPMENT

Flush Mounting Frames

The latest addition to the "New-range" lighting fitting components made by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, is a flush mounting frame designed to enable all standard industrial type "New-range" fittings for 5ft, 4ft, 3ft and 2ft fluorescent tubular lamps to be recessed into false ceilings.

The new frame has an anti-corrosive "Permawhite" enamel finish and no external screws are necessary to secure it in position. It is first attached to the closed end plates of the fitting and the whole assembly is drawn into position by means of the suspension arrangement, e.g. by the use of locknuts on the threaded conduit. The advantage of this method is that the false ceiling does not have to support the weight of the fitting or even the frame.

All normal maintenance can be carried out from below, the louvres, diffusers and reflectors being easily removable for service.

Ultrasonic Generator

A composite low frequency ultrasonic generator, Type E.7589, manufactured by MULLARD, LTD., Mullard House, Torrington Place, London, W.C.1, provides from a single source suitable outputs for supplying the Mullard 50 W ultrasonic drill and the soldering iron or tinning bath. It supplements the separate generators, Types E.7685 and E.7595, supplied for use with the drill and the soldering iron or tinning bath, respectively.

The nominal output is 50 W and the ultrasonic frequency is variable by means of a single control up to 30 kc/s. The transducers incorporated in the drill, soldering iron and tinning bath are designed for operation at around 20 kc/s. The generator also provides a suitable supply for heating the bit of the soldering iron. Its dimensions (12in by 10in by 11in high) are identical with those of the separate generators mentioned above.

Terminal Blocks

The multi-lock terminal blocks recently introduced by M.T.E. CONTROL GEAR, LTD., Leigh-on-Sea, Essex, provide a unique method of making terminal connections for control panels, motor starters, switchboards, etc., where it is necessary to bring wires or cables into or out of a confined space.

They are constructed in precision made interlocking phenolic mouldings and are available in three sizes, 10, 30 and 75 A. The last two sizes will interlock with each other. Their clamp-type terminals are self-enclosing, obviating the need for soldered ends or special terminal tags, and the terminal plates are knurled to provide anchoring strength.

Any number can be mounted directly on to a panel without the use of special brackets or channels. Assemblies of up to six single units can be fastened by only two screws. Plastic letters or numbers for coding can be supplied for inserting into slots provided in the terminal mouldings.

Street Lighting Lantern

An aero-screened "Mazda" "Sapphire" mercury street lighting lantern has recently been adopted as standard equipment by the A.E.I. LAMP & LIGHTING CO., LTD., Crown House, Aldwych, London, W.C.2. It was designed to Ministry of Transport and Civil Aviation specification for use in the vicinity of airfields, and is also suitable for general applications where completely glare-free lighting is required. Cut-off models of both the "Sapphire" and the "Amber" (sodium) lantern have also become available as part of the company's stocked range of street lighting equipment. In all three variations the cut-off shield or aero-screening is located within the lantern.

Rivet Heating and Closing

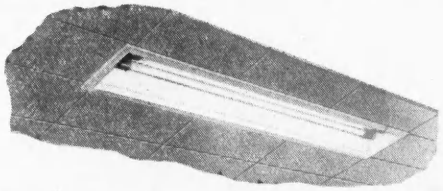
Of special interest to turbine builders is the latest heating and closing machine for medium tensile ferrous rivets designed and manufactured by HOLDEN & HUNT, LTD., Cox's Lane Works, Old Hill, Staffs. The machine illustrated has been developed and built for hot closing rivets for the assembly of blades to rotor shafts in high speed turbines.

The heating and closing electrodes operate on a horizontal plane and the arms have a throat depth sufficient to enter into and between the blade assemblies to be riveted to the rotor shaft supported horizontally. The arm pivot centres are adjustable to accommodate various lengths of rivets.

The machine has a nominal electrical rating of 30 kVA and is capable of heating and closing rivets up to $3\frac{1}{2}$in long by $\frac{3}{8}$in diameter, in certain specification steels. The electrode arms are actuated and the "closing" pressure applied by a double-acting air cylinder through an adjustable toggle system.

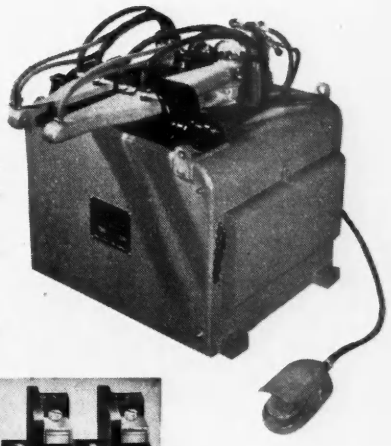
The period of the heating and closing cycle is controlled by an electronic timer, the "heating" and "closing" circuits being interlocked.

The body of the machine follows the latest machine tool practice in the form of a fabricated structure of pleasing lines. Whilst all control gear is in-built, it is readily accessible for adjustment and maintenance.



Crompton recessed frame with AC.21 closed top "New-range" lighting fitting

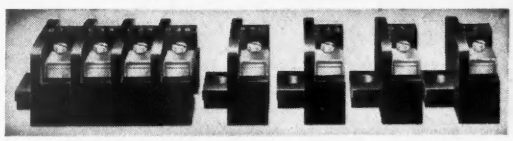
A.E.I. Lamp & Lighting Co.'s "Sapphire" Group "A" mercury street lighting lantern



Heating and closing machine for medium tensile ferrous rivets (right)

Mullard composite 50 W ultrasonic generator

M.T.E. Control Gear multi-lock terminal blocks



Financial Section

STOCKS and SHARES

THE opening of the Budget at least removed one of several uncertainties which have been obstructing for some time the normal flow of Stock Exchange business. Previously, the review by Lord Chandos at the annual meeting of Associated Electrical Industries had reassured the market in electrical engineering shares in its disposition not to attach overmuch importance to the £5 million setback in the group's 1956 profits. Unfavourable conditions for the company's lighter products had been taken for granted. There is also confirmation now of the initial assumption that a number of the new factories had not only had insufficient time to begin their contribution to earnings, but that these projects involved heavy initial expenses of a non-productive nature. In short, the chairman regards last year's results as an unreliable guide to potential earning capacity when the latest expansion begins to take effect. Planning continues on the basis that the electrical industry will nearly double its size in the next decade, an assumption backed by the past experience of A.E.I., in which the capital employed has grown from £22 million in 1946 to over £100,000 to-day.

Convertible Stocks

The resounding success of a recent £2 million issue by the Pressed Steel Company confirms the popularity enjoyed at present by the relatively novel form of investment which carries a fixed and strongly secured rate of interest in combination with an option to convert holdings later into the same company's ordinary shares. Pressed Steel's new stock is a 5½ per cent debenture, redeemable at par between 1977 and 82, which holders may, if they wish, exchange for the company's 5s ordinary shares between June of next year and 1961, in proportions declining from 35 shares per £25 stock in 1958, to 32 shares per £25 stock in 1961. Having been heavily oversubscribed, the new issue went in early dealings to a premium of 9 points on the offered price of 100. On the basis of the all-in price of 109, the conversion terms give in effect an option to exchange into the ordinary shares in the four-year period at prices rising from 15s 7d to 17s. Their market price has lately been about 14s 9d; they were quoted above 20s before trouble overtook the motor industry last year.

Market Notes

Dealings will be due to start next week in another convertible stock through the Electric Construction Company's issue of half a million 5¾ per cent convertible loan stock, for which the list of applications from stockholders, at a price of 99, closes on Monday (15th). Dictograph Telephone 2s shares were raised in the market from 7s to 7s 6d after news of the company's intention to distribute a one-for-four scrip issue and thereafter to maintain the interim dividend for the current year at 10 per cent on capital so increased. An annual total of 20 per cent has been paid since

Price Changes in

Company or Board	Nom. Value	Middle price 8th April	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	77½	+1	3	3	3 17 6	80	75
Brit. Elec. 1974/77	100	75½	+1	3	3	3 19 6	78½	73½
Brit. Elec. 1976/79	100	78½x.d.		3½	3½	4 9 3	81½	77¼
Brit. Elec. 1974/79	100	89⅜		4¼	4¼	4 15 0	92½	87¼
Overseas Electric Supply								
Calcutta Elec.	£1	18/6		6†	6†	6 9 9†	19/-	18/3
East African Power	£1	20/-		7	7	7 0 0	20/6	19/3
Nigerian Elec.	£1	17/6		10	10*	11 8 6	18/6	17/3
Perak Hydro-Elec.	£1	15/-	+3d	10	10*	13 8 3	15/-	13/3
Electrical Shares								
Aberdare Cables	5/-	10/3		17½	17½	8 10 9	11/3	9/9
Aerialite	1/-	5/6		45	48	8 14 6	6/-	4/9
Allen, W. H.	£1	40/-		20	10*	5 0 0	40/-	33/6
Aron Elec. Ord.	£1	56/3		15	15	5 6 9	55/6	53/6
Assd. Automation	10/-	20/-	—3d	10	5	2 10 0	20/9	17/9
Assoc. Elec. Ord.	£1	66/3	+3/9	15	15	4 10 6	73/-	62/6
Automatic Tel. & El.	£1	62/6	+1/3	15	15	4 16 0	62/6	54/6
Babcock & Wilcox	£1	80/-	+1/3	15	15	3 15 0	82/6	71/6
Baldwin, H. J.	2/-	4/6		20	20	8 17 9	5/-	4/-
Bakelite	10/-	24/3	+1/9	16	15	6 3 9	24/3	20/9
Berry's Electric	5/-	5/9		—	10‡	8 14 0	5/9	5/6
British Aluminium	£1	68/9	+2/6	12	12	3 9 9	70/6	63/9
B.I. Callender's	£1	52/3	+1/6	10	12½	4 15 9	52/3	48/3
B.I. Callender's 6% Pref.	£1	21/9		6	6	5 10 3	21/9	20/6
British Tabulating	£1	52/-		9	9	3 9 3	52/6	42/-
British Thermostat	5/-	27/-		20	25	4 12 6	27/6	25/9
British Vac. Cleaner	5/-	7/-		30	15*	10 14 6	8/-	6/6
Brook Motors	10/-	31/3		25	25	8 0 0	33/3	30/-
Brush Group	5/-	5/9	+6d	10	Nil	Nil	6/3	4/6
Bulgin, A. F.	1/-	5/-x.d.	+3d	50	40*	8 0 0	5/6	4/6
Burco Dean	5/-	11/3	+3d	22½	20	8 17 9	11/3	8/9
Chloride El. Storage "A"	£1	66/9	+1/-	17½	17½	5 4 9	68/-	58/-
Clarke Chapman	£1	152/6	—2/6	22½	27½	3 12 3	7⅞	6½
Cole, E. K.	5/-	19/9	+6d	17½	17½	4 8 6	19/9	16/6
Cossor, A. C.	5/-	6/9	+6d	15	Nil	Nil	7/3	5/9
Crabtree	10/-	24/6		20	20	8 3 3	25/6	23/3
Crompton Parkinson Ord.	5/-	16/3		16	16	4 18 6	17/9	14/6
De La Rue	5/-	18/6	+1/-	30	30	8 2 3	19/9	16/3
Decca "A"	4/-	29/3	+2/3	43¾	43¾	5 19 9	32/3	27/-
Desoutter	5/-	31/-		30	32½	5 4 9	30/-	27/6
Dewhurst	2/-	6/6		30	16¼*	5 0 0	7/6	5/9
Dictograph Tel.	2/-	7/-		20	20	5 14 3	7/6	6/9
Dubilier Condenser	1/-	5/3		25	30	5 14 3	5/9	5/6
Duport	5/-	18/6		23	25	6 15 3	19/6	17/6
E.M.I.	10/-	32/6	+2/-	15	15	4 12 3	32/6	23/9
Electrical Components	5/-	7/3		25	25	8 12 6*	7/3	6/6
Elec. Construction	£1	25/-		8½	8½	6 16 0	25/6	21/9
Elliott Bros.	5/-	27/6	+6d	17½	20‡	3 12 9	29/-	26/3
Enfield Cable Ord.	£1	16/6		Nil	Nil	Nil	21/6	13/-
English Electric	£1	58/9	+1/3	12½	14	4 15 3	58/9	47/6
English Electric 3¾% Pref.	£1	13/-		3¾	3¾	5 15 6	14/3	13/-
Ericsson Tel.	5/-	41/-	+1/6	20†	22†	2 13 9†	41/-	33/3
Ever Ready	5/-	31/6	+3d	35	35	5 11 0	31/9	30/-
Falk Stadelmann	£1	39/-		17½	17½	8 19 6	38/6	35/-
G.E.C. Ord.	£1	56/3	+1/3	12½	14	4 19 9	57/9	48/9
G.E.C. 6½% Pref.	£1	22/6		6½	6½	5 15 6	23/6	22/-
General Cables	5/-	12/9		30	30	11 15 3	13/6	11/6
Greenwood & Batley	£1	46/3		17½	17½	7 11 3	46/3	45/3
Hackbridge Holdings	5/-	21/3	+1/-	25	30	7 1 3	21/3	19/9
Hackbridge & Hewittic	5/-	15/-		30	23*	7 13 3	16/-	13/6
Head Wrightson	£1	132/6		17½	20	3 0 6	132/6	112/6
Heatrae	2/-	4/-		15	15	7 10 0	4/-	4/-
Henley's	10/-	16/6	—3d	10½	11½	6 19 6	17/-	15/3
Holophane	5/-	23/-		30	30	6 10 6	26/3	17/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

before the last scrip issue, a one-for-five distribution made four years ago. Assuming the same total for this year, there is a prospective yield of 6⅔ per cent on the shares. Chloride Electrical Storage are expected to announce the final dividend and the results for 1956 next Wednesday (17th) and Babcock & Wilcox theirs a week later.

E.M.I. and Thorn

After a slow initial reaction, the shares of Electric & Musical Industries and of Thorn Electrical Industries later reflected a decidedly favourable interpretation of the news that the two companies were to merge their radio and television receiver interests into a jointly owned enterprise. Under this plan, the new company is to carry on the design and marketing of all receivers under the trade marks of Ferguson, H.M.V. and Marconiphone. Production is to be concentrated mainly in the Thorn factories, and through rationalisation the result is calculated to bring strength to the competitive position. Mr. Julian Thorn is to be chairman of the joint enterprise.

Electrical Investments

Company or Board	Nom. Value	Middle price 8th April	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1957 Highest	1957 Lowest
Electrical Shares—continued						£ s d		
Hoover	5/-	37/6	+1/-	50	50	6 13 3	37/6	24/9
I.C.I.	£1	44/9	+1/6	10	10	4 9 6	44/9	37/9
Intl. Combustion	5/-	27/-	+1/3	20	22½	4 3 3	27/3	20/-
Johnson & Phillips	£1	30/-	+6d	15	15	10 0 0	34/6	28/6
Lancashire Dynamo	£1	43/9	+1/3	15	11*	5 0 6	45/-	36/9
Laurence, Scott	5/-	18/3	+6d	12½	15	4 2 3	18/3	13/9
Lister, R. A.	£1	29/3		9·3	10	6 16 9	30/6	26/9
London Elec. Wire	£1	53/9		12½	12½	4 13 0	53/9	43/-
Lucas, J.	£1	35/-	+2/6	7½	7½	4 5 9	35/-	30/6
Marryat & Scott	2/-	9/3		30	30	6 9 9	9/6	8/-
Mather & Platt	£1	56/-	+6d	15	15	5 7 3	56/-	51/3
Metal Industries	£1	26/3	+3/3	9	Nil	—	26/3	20/3
Midland Elec. Mfg.	£1	47/6		12½	12½	5 5 3	47/6	45/-
Morphy-Richards	4/-	15/-	+1/-	50	50	5 6 9*	15/-	11/9
Murex	£1	74/6	+2/3	20	20	5 7 6	74/6	65/-
Newman Ind.	2/-	2/6		10	10	8 0 0	2/6	2/1
Oldham & Son	1/-	2/6		20	17½*	7 0 0	2/6	2/3
Parnall (Yate)	5/-	8/-	+6d	14	12	7 10 0	8/-	5/9
Parsons, C. A.	£1	68/9	+3/9	10	10	—	70/-	50/6
Plessey	10/-	77/-	+6d	27½	30	3 18 0	77/6	61/-
Pye "A" Deferred	5/-	18/-	+6d	12½	12½	3 9 6	18/3	15/9
Reyrolle	£1	105/-	+3/9	16½	17½	3 6 9	110/-	90/-
Rheostatic	4/-	10/-		18½	12½*	5 0 0	10/-	8/9
Richardsons Westgarth	5/-	19/-	+1/-	16⅔	16⅔	4 7 9	19/-	17/-
Scottish Cables	4/-	17/9		27½	27½	6 4 0	19/3	15/-
Simon-Carves	5/-	30/-		30	28⅔*	—	30/9	26/-
Smith (England), S.	4/-	14/6		17½	17½	4 16 6	14/6	13/-
Southern Areas	£1	17/6		10	7½	8 11 6	20/-	13/9
Strand Elec.	5/-	7/6		15	15	10 0 0	8/-	7/3
Sturtevant	5/-	26/-		14·4†	15†	2 17 9†	26/-	24/3
Sun Elec.	£1	43/9		20	25	11 8 6	43/9	43/9
Switchgear & Cowans	5/-	14/3		20	25	8 15 6	15/6	13/6
Taylor Tunnicliff	5/-	13/3	+6d	15	15	5 13 3	13/9	11/9
T.C.C.	10/-	38/9		25	25	6 9 0	38/9	35/-
T.C. & M.	£1	28/-	—1/-	8½	8½	6 1 6	31/-	24/6
Telephone Mfg.	5/-	7/6	+6d	10	10*	6 13 3	7/6	6/3
Thompson (John)	5/-	32/9		25	25*	3 16 3	37/-	29/3
Thorn Elec.	5/-	22/-	+1/3	15	15	3 8 3	22/-	16/3
Thornycroft	£1	37/6		15	12½	6 13 3	37/6	32/9
Tube Investments	£1	65/-	+1/3	22½	15*‡	4 12 3	65/-	58/3
Vactric	5/-	18/9		15	17½*	4 13 3	18/9	12/9
Veritys	5/-	8/3		12½	12½	7 11 6	9/3	8/3
Walsall Conduits	4/-	13/6	+3d	70	20*	5 18 6	13/6	11/-
Ward & Goldstone	5/-	44/3	+1/-	30	35	3 19 0	44/3	36/9
Watford	2/-	6/6		25	25	7 13 9	6/6	6/3
Westinghouse	£1	82/6		18	18	4 7 3	82/6	72/-
West, Allen	5/-	14/3	+6d	15	15	5 5 3	14/3	12/3
Wolf Electric	5/-	19/6		20	20	5 2 6	19/6	17/3
Trusts, Transport and Communications								
Anglo-Portuguese Tel.	£1	23/9		8	8	6 14 9	23/9	20/6
Brit. Elec. Traction: Def. Ord. "A"	5/-	20/6	+6d	22½	22½	5 9 9	20/9	17/-
Cable & Wireless: Ord.	5/-	11/3	+3d	10	10	4 9 0	12/-	9/6
4% Loan	100	92½		4	4	4 6 6	92½	89
Marconi Marine	£1	33/6		10	10	5 19 6	33/6	31/-
Telephone Rentals	5/-	11/9	+9d	12½	12½	5 6 6	11/9	10/3

Radio Business

Figures published recently by the radio and television trade have put a much better complexion on the state of business. In the latest of them, the January and February sales of television sets, aggregating 213,000, are shown to have been 28 per cent better than last year's corresponding number, and there were comparable improvements in the radio and radiogram sections.

Decca Record's annual meeting, and Murphy Radio's dividend declaration, contributed towards keeping the radio industry in the recent news. Decca 4s shares were well supported after the meeting, which considered the accounts for the year ended March, 1956, and took place a day or two after the completion of the following twelve months. For the latest period Mr. E. R. Lewis anticipated considerably increased earnings: in the first nine months output had been 30 per cent above the previous year's level. He also confirmed the forecast that this year's dividends, paid on increased capital, would amount to not less than the present rate of 43¾ per cent. Murphy Radio 5s shares also improved after the announcement of the maintenance of the dividend at 20 per cent, and of an increase in profits, before tax.

Clarke Chapman

In a reference here to Clarke, Chapman & Co. £1 shares last week, the company was mentioned mistakenly as being a partner with International Combustion and Crompton Parkinson in the nuclear power field. The company's association is of course with the group comprising A. Reyrolle, C. A. Parsons, Head Wrightson and others in the Nuclear Power Plant Company. At last week's meeting, Mr. J. B. Woodeson referred to the booking of this group's first order for the power station to be built at Bradwell, in which Clarke Chapman will be responsible for much of the erection work and, jointly with Head Wrightson, for the steam-raising equipment. Since the meeting, Clarke Chapman shares have remained in demand, dealings being recorded up to £7⅞ at the beginning of this week (the official quotation remained at £7⅝). At this level they are showing an appreciation of some £3 per share in comparison with their value a year ago.

REPORTS and DIVIDENDS

Associated Electrical Industries, Ltd.—At the annual meeting on 3rd April, Lord Chandos (chairman) gave some of the reasons for the less favourable results in 1956 as compared with 1955. These were reduced profit margins, Government action in the early part of the year which caused a sharp fall in the demand for a number of the group's lighter products; keen competition in lamps and lighting; and organisation of new factories which had not yet made any appreciable addition to their revenue.

Although profits were lower, the total value of electrical apparatus shipped overseas surpassed the record year of 1955 by approximately £5·4 million. The second half of 1957 should witness the first beginnings of revenue from the new factories. There had been an unusually large influx of orders since the turn of the year. The order book was in a healthy condition and ensured that their capacity would be employed at a high rate for at least the next year or two.

Referring to the Restrictive Trade Practices Act, Lord Chandos said that whatever the effects might be upon the electrical industry, they must guard against the dangers of slowing down research, technical development and improvement of factory equipment, all of which were essential to industrial progress, particularly in this, the chief exporting industry of Great Britain.

The chairman reviewed the various changes in the organisation and development of the company and mentioned that the complete integration of Siemens Brothers & Co., Ltd., and the Edison Swan Electric Co., Ltd., would be completed by the middle of the current year. He referred to the formation of the A.E.I.-John Thompson Nuclear Energy Co., Ltd., and mentioned that one-third of the capital was held by the B.T.H. Co., one-third by Metropolitan-Vickers and one-third by John Thompson. They had recently formed a company in Australia called Ediswan-Ekco (Aust.) Pty., Ltd., for the manufacture of television sets, the capital of which was held equally by themselves and E. K. Cole, Ltd. The Indian Government had recently accepted their project report for the heavy electrical plant factory to be built under their guidance at Bhopal and the first team of Indian engineers was now training in their factories.

Lord Chandos gave figures showing the expansion of the company over the past ten years. He mentioned that in 1946 a typical large turbo-alternator was about 30,000 kW; to-day they had sets in commission of 100,000 kW and were engaged in the manufacture of 200,000 kW sets. They were now studying the development of machines generating over 500,000 kW.

Last year Metropolitan-Vickers put into service the world's first generator having direct water-cooled windings. This led to the possibility of still further reduction in the physical size of generating plant. Over 1,800,000 kW of major generating plant was commissioned during the year. Of this, 610,000 kW was for the Central Electricity Authority and the remainder, nearly two-thirds of the total, represented plant installed overseas. During last year they received orders from the Admiralty for combined gas and steam turbine machinery to power fast escort vessels. They had recently sold two "Merlin" research reactors, one to Western Germany and one to the Atomic Weapons Research Establishment. These reactors were research tools of great potential, and they were producing them at a price which was about half that of any similar reactor which could be offered by any company in the world.

Turning to the more conventional types of plant Lord Chandos said, in referring to hydro-electric schemes, that Metropolitan-Vickers would supply five 100,000 kW generators and the B.T.H. Company was manufacturing the 330 kV oil circuit-breakers for the Kariba scheme. The two orders totalled approximately £4,000,000. Other notable orders include five 90,000 kW generators for the Bhakra Dam in India, and 330 kV air-blast switchgear for the Snowy Mountains Authority in Australia. The largest horizontal waterwheel generator in Great Britain had been put into commission at the Finlarig station of the North of Scotland Hydro-Electric Board.

They were well advanced in the development of automation and computers. During the year B.T.H. had extended the range of electronic controls which could be applied to machine tools. In particular they led the world in controlling machine tools automatically from information on punched cards, and this system gave an accuracy of one-tenth of one-thousandth of an inch. These and other developments would do something to offset the shortage of qualified engineers.

They had continued to make remarkable advances in the use of germanium and silicon. A 2,000 kW germanium power rectifier commissioned in France was the first of its kind in Europe, and they had now built a prototype silicon rectifier with an output of 15 kW, probably the first unit of this rating in this country. For the first time in the world an electric train using power from a germanium rectifier had been on trial; this rectifier was of their manufacture. The new factory for the manufacture of germanium high power rectifiers had been built at Rugby and was now in production. They had also bought a factory in Lincoln which they were adapting for the manufacture of low power devices on a large scale, and they would be going into full production of germanium valves at their new factory at Tottenham.

Lord Chandos also referred to the group's successes with its other products such as transformers, switchgear, rolling mill motors, electric winders for the mining industry, cables, and public and private telephone equipment, for which, he said, the demand had been well maintained. He referred to the large expansion programme which they had undertaken and mentioned that with the increasing demand for diesel-electric and electric traction they had been obliged to build a new factory at Sheffield. Large extensions to their research and development establishments had proved necessary. All the research laboratories of the Siemens-Ediswan group would be brought together on a new site at Harlow, and they were developing a so-called "hot" laboratory for investigating the properties of radioactive materials.

They were continuing to expand their facilities for training, and were paying particular attention to the supplementary courses for their staff. They had doubled their apprentice training school at Trafford Park, and large additions were nearly ready at Coton House, the B.T.H. hostel for apprentices at Rugby. Lord Chandos concluded by saying that the company had a manufacturing space of sixteen million square feet. It was all fully committed to production, and the group were in need of the help which their new expansions would give it.

As in previous years the company has issued a pictorial review of the group's achievements in 1956.

Clarke, Chapman & Co., Ltd.—Presiding at the annual meeting held on 4th April, Mr. J. B. Woodeson (chairman) said they had carried out a great deal of research work in both hand and machine welding. Extensive investigation had also taken place into the application of ultrasonic examination of welds. This would prove especially useful for the examination of site welding, particularly when erection on the nuclear power stations commenced. With their entry into the nuclear field, additional and entirely new lines of research and development were necessary.

Referring to the marine business the chairman said that in the Electric Winch Department they had been extremely busy. With regard to a.c. equipment considerable advances had been made and they could offer several alternative schemes for auxiliaries which required a.c. drive. The new Control Gear Department which was only completed in 1955, had played a large part in maintaining the present high output of electrical deck machinery. In the Boiler Department

the first order had been booked by the Nuclear Power Plant Co., Ltd., of which Clarke, Chapman was a member for an atomic power station and, associated with Head Wrightson & Co., Ltd., they had the responsibility for the steam raising equipment at Bradwell. In addition they would be responsible for a large part of the erection work and for providing plant services at the site during construction. They were associated with the Anglo-Great Lakes Co., Ltd., for the production of reactor graphite.

So far as conventional steam-raising plant was concerned, in 1956 the Boiler Department commissioned water-tube boilers at power stations of the C.E.A. and also for several industrial projects. Two large units were on order for installation at Londonderry to the instructions of the Northern Ireland Electricity Board. Further orders were received for units for the National Coal Board and the paper industry. They had booked several steam-raising plants for erection in India.

The Rheostatic Co., Ltd.—The main figures in the accounts were given in our issue of 15th March. In his statement which accompanies the report and accounts, Mr. M. J. Gartside (chairman and managing director) says that the past year has been marked by the completion of the extensions to the Frimley premises, and during the year the opportunity arose of acquiring a long-term lease of a factory on the Slough Trading Estate. The competition which is being experienced demands continuing advancement in order that the company may maintain its position in the temperature control field and, therefore, an increasing proportion of its resources is being utilised in the technical development and research departments which have been expanded during the year. New designs of "Satchwell" temperature controls have been introduced and a continuous flow of new devices is planned for the future. The persistence of credit restrictions coupled with the uncertainty in the oil burning field as a result of the closing of the Suez Canal has had its effect on progress during the current financial year, but in spite of these adverse factors, sales for the first six months of the current year are appreciably the same as those of the corresponding period last year.

Decca Record Co., Ltd.—In the course of his speech at the annual meeting held on 2nd April, Mr. E. R. Lewis (chairman), said that navigator hirings had increased at a considerably higher rate than in any previous year, the cumulative total of hire and sale contracts up to 31st January last amounting to 3,770 units. A long range version of the Decca navigator system, known as "Dectra" had been developed, in particular in the hope that it would provide a solution to the problem of navigation on the North Atlantic air route. The first trials were carried out during the year of the Mark 10 Decca, representing a fundamental advance in the techniques of radio-navigation. Orders for marine radar had continued at a satisfactory rate during the current year and they had at present a large "backlog" of orders.

Enfield Rolling Mills, Ltd.—A fall in the group trading profit from £2,139,522 in 1955 to £1,553,888 last year is reported by the company, and after deducting £619,000 for taxation and £151,647 for depreciation, the net profit is £531,474 (against £938,465). General reserve receives £618,108 and it is proposed to pay a final dividend of 10 per cent on capital doubled to £3,110,000 by a scrip issue, making with the interim of 5 per cent paid on the smaller capital, 15 per cent for the year. For 1955 the distribution was 22½ per cent, of which the interim dividend was paid on capital of £1,425,000 and the final dividend on £1,555,000. Stockholders are reminded that 1955 was an exceptional year in which substantial profits were made on stocks owing to rises in metal prices. In 1956 no such fortuitous profits were made, but there were, however, no stock losses, despite the fall in metal prices.

The Pulsometer Engineering Co., Ltd., reports a group profit for 1956 of £343,186, as compared with £341,553 for the preceding year. Taxation absorbs £196,645 and the net balance is £146,541 (against £167,604). A sum of £70,000 is placed to general reserve and it is proposed to pay a final dividend of 12½ per cent, making 22½ per cent for the year on £560,000 ordinary capital (against 25 per cent for 1955 on £237,840). The balance carried forward is £24,315 (against £24,272 brought in).

Murphy Radio, Ltd.—Group profits for 1956 amounted to £544,524, as compared with £502,421 for 1955, and the net balance after providing £311,817 for taxation was £235,555 (against £244,375). General reserve receives £100,000 and the ordinary dividend for the year is maintained at 20 per cent. The balance carried forward is £257,005 (against £246,656 brought in).

Senior Economisers, Ltd.—Trading profits for 1956 amount to £243,747, as compared with £198,225 for the previous year, and after providing £133,717 for taxation, the net profit is £110,030 (against £89,320). General reserve is allocated £70,000, and it is proposed to pay a final dividend of 27½ per cent (against 25 per cent), making 47½ per cent for the year (45 per cent). The balance carried forward is £59,349 (against £49,992 brought in).

Blaw Knox, Ltd., report a trading profit for 1956 of £389,097, as compared with £388,089 for 1955. Taxation requires £169,509, and reserves receive £100,000. The ordinary dividend for the year is maintained at 30 per cent with a final dividend of 20 per cent. The balance carried forward is £276,821 (against £282,333 brought in).

G. & J. Weir, Ltd.—After meeting all charges, including £1,517,752 for United Kingdom taxation, the group net profit for 1956 is £1,401,414, as compared with £1,573,675 for 1955. The profit of the parent company is £964,436 (against £1,059,397). A sum of £600,000 is allocated to reserve, and it is proposed to maintain the dividend for the year at 30 per cent by a final payment of 22½ per cent. The balance carried forward is £338,869 (against £322,591 brought in). It is proposed to capitalise £2,018,307 of reserves for a one-for-one scrip issue.

Wright & Weaire, Ltd.—The net profit for 1956 is £41,420, as compared with £30,154 for the preceding year. The dividend for the year is 30 per cent (against 25 per cent).

Relay Exchanges, Ltd., reports that after charging £822,958 for depreciation and renewals and £125,216 for taxation, the group net profit is £224,330 for 1956, as compared with £298,630 for 1955, all of which is attributable to the parent company. It is proposed to pay a final dividend of 20 per cent (against 12½ per cent), which with the interim dividend, makes 32½ per cent for the year (against 20 per cent).

Richardsons, Westgarth & Co., Ltd., have made an offer to acquire Parsons Marine Turbine Co., Ltd. The offer is eleven Richardsons, Westgarth stock units of a nominal value of 5s each in exchange for two Parsons Marine shares of a nominal value of £1 each. The offer remains open until 27th April and is conditional upon the acceptance by the holders of not less than 90 per cent of the Parson Marine Co.'s capital, or such lesser percentage being not less than 75 per cent as Richardsons, Westgarth may decide to accept.

New Companies

J. Merrifield, Ltd.—Registered 21st March. Capital £1,000. Electricians, etc. Directors: J. Merrifield and Mrs. Kathleen Merrifield. Regd. office: 25, Churchfields Road, Brighouse.

James Green (Newcastle), Ltd.—Registered 25th March. Capital £2,000. Radio, television and electrical engineers, etc. Directors: J. Green and Mrs. Mary Green. Regd. office: 11, Saville Row, Newcastle-on-Tyne, 1.

Altham Radio Co., Ltd.—Registered 22nd March. Capital £10,000. Manufacturers of and dealers in electronic equipment and components, etc. Directors: L. H. Altaras and Marjorie J. Altaras. Regd. office: 27, Brazennose Street, Manchester, 2.

Dri-Clo, Ltd.—Registered 22nd February. Capital £1,000. Manufacturers of and dealers in and agents for manufacturers of domestic, household and general electrical and other equipment, including clothes drying appliances, washing and cleaning machines, etc. Directors: S. Marshall, D. Marshall, T. Marshall, J. Poole and J. R. Dulson. Regd. office: 1a, Sugar Lane, Manchester, 4.

Clarovox Products, Ltd.—Registered 7th March. Capital £1,000. Manufacturers of and dealers in electrical, electronic and mechanical devices, transformers of all kinds,

motors, dynamos, etc. Directors: F. Waldman and Mrs. Lillian Cooke. Regd. office: 465, Walsgrave Road, Coventry.

James G. Parks, Ltd.—Registered 12th March. Capital £7,500. Electrical engineers, etc. Directors: J. G. Parks and Mrs. Helen M. Parks. Regd. office: 85, High Street, Tonbridge, Kent.

Ironside Electrical Contracting Co., Ltd.—Registered 22nd February. Capital £2,000. Directors: E. W. Davis and E. L. Baylis. Solicitors: Johnson Mileham & Scatliff, Brighton.

Lamstaf, Ltd.—Registered 6th March. Capital £1,250. Manufacturers of and dealers in electrical, radio and television apparatus, etc. Directors: E. Lambert and F. A. Stafford. Regd. office: 405, Caledonian Road, N.7.

G. E. Samways & Son, Ltd.—Registered 15th March. Capital £10,000. Electrical, radio, electronic and mechanical engineers, etc. Directors: G. E. Samways, Mrs. Mona H. Samways and R. W. Dawson. Regd. office: Radio and Television Centre, 399-401, London Road, Hazel Grove, Ches.

Dirks Electronic, Ltd.—Registered 15th March. Capital £1,000. To manage, exploit, develop and if necessary to acquire the existing and future inventions, patents and patent applications of Dr. Gerhard Dirks relating to electric and electronic processes and apparatus and engineering generally, etc. Directors: Dr. G. Dirks and S. E. M'Caw. Regd. office: 49, King Street, Manchester.

Electronics (Canterbury), Ltd.—Registered 19th March. Capital £2,000. Manufacturers of and dealers in radio, electrical and mechanical apparatus of all kinds, etc. Directors: N. V. Stephan and W. F. J. Seymour. Regd. office: 31, St. George's Place, Canterbury.

W. & L. Cole (Electrical), Ltd.—Registered 8th February. Capital £1,000. To carry on the business of electrical engineers and contractors, radio engineers, etc. Directors: A. Mitchell, E. W. Still, W. J. Caulfield and S. T. Saunders. Regd. office: 21-3, Clinton Road, E.3.

Liquidations

Smith Poole & Co., Ltd., electrical and wireless engineers.—Winding up voluntarily. Liquidator, Mr. S. T. H. Tarr, 7, Castle Street, Bridgwater, Somerset, appointed 26th March.

Marwoodson & Co., Ltd., manufacturers of electrical components.—Liquidator, Mr. D. F. Gay, 39-41, New Broad Street, London, E.C.2, released 6th November, 1956.

Thames Technical Co., Ltd., wholesalers of electric lamps and tap washers.—Last day for receiving proofs for dividend, 18th April. Liquidator, Mr. A. E. Attwood, 20-21, Lawrence Lane, Cheapside, London, E.C.2.

Rentalec, Ltd., dealers in electrical equipment.—First and final dividend of 3¼d in the £, payable at the office of the Official Receiver and Liquidator, Inveresk House, 346, Strand, London, W.C.2.

Bankruptcies

G. Dickinson and **K. G. Dickinson,** carrying on business in partnership under the style of G. & K. G. Dickinson, at 134, Clipsley Lane, and 321, Church Road, Haydock, Lancs., electricians.—Trustee, Mr. S. O. Henry, 5, Rumford Place, Chapel Street, Liverpool, appointed 26th March.

G. E. Stephens, 57, Hathaway Road, Grays, Essex, electrical engineer, lately carrying on business as an electrical contractor from 142, Old High Street, Grays.—Trustee, Mr. W. J. W. Hill, 58-61, York Terrace, Regent's Park, London, N.W.1, Official Receiver, released 21st March.

W. C. Lawman, 27, Selbourne Road, Luton, electrician, lately residing at 11, Ashburnham Road, Luton.—Application for discharge to be heard on 2nd May at the Court House, Stuart Street, Luton.

K. R. Clover, carrying on business as K. R. Clover & Co., at 3, Market Cross, Sturminster Newton, Dorset, radio and electrical engineer.—Last day for receiving proofs for dividend 16th April. Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates do not clash with others already arranged.

Monday, 15th April

BIRMINGHAM.—Grand Hotel, 6.15 p.m. Birmingham Electric Club. "K.E.M.A. Laboratories, Netherlands," by Prof. ir. G. de Zoeten.

IPSWICH. — Electric House, 7.15 p.m. Ipswich and District Electrical Association. "Fertiliser Production," by J. J. Porter.

LEICESTER.—Royal Hotel. I.E.S. Leicester Centre. Annual general meeting.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "The Future of Plastics in Power Cables," opened by C. C. Barnes.

MANCHESTER.—Grand Hotel, 6.45 p.m. Institution of Works Managers, Manchester Branch. Annual general meeting.

STONE.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Electronics and Automation—Some Industrial Applications," by Dr. H. A. Thomas.

Tuesday, 16th April

BELFAST.—Lombard Café, Lombard Street, 6.30 p.m. I.E.E. Northern Ireland, Graduate and Student Section. Annual general meeting.

CHELTENHAM.—Belle Vue Hotel. I.E.S. Gloucester and Cheltenham Centre. Annual general meeting.

EDINBURGH.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "An Introduction to some Technical Factors affecting Point-to-Point Radio Communication Systems," by F. J. M. Laver.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilisation Group. "Electrical Floor Warming," by J. W. Moule and W. M. Stevenson.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. Discussion on "The Measurement of Currents in High-Voltage Circuits without Orthodox Current Transformers," opened by M. Kaufmann and Dr. A. J. King.

Great George Street, S.W.1, 5.30 p.m. Institution of Civil Engineers. "Railway Diesel Traction and Associated Problems," by A. B. Henderson.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.30 p.m. Association of Supervising Electrical Engineers. Discussion on "13th Edition I.E.E. Regulations," opened by A. V. Milton.

Charing Cross Hotel, 7 p.m. Institute of Commercial and Industrial Managers. "Automation in the Smaller Business," by J. A. Sargrove.

Wednesday, 17th April

LONDON.—Waterloo Bridge House, S.E.1, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "D.C. Signalling—Are its Days Numbered?" by R. F. Howard.

1, Birdcage Walk, Westminster, S.W.1, 6.45 p.m. Institution of Mechanical Engineers. Industrial Administration and Engineering Production Group. Discussion on "The Importance of Internal Communications in an Engineering Works."

NEWCASTLE-UPON-TYNE. — King's College, Stephenson Buildings, 7 p.m. Society of Instrument Technology, Newcastle Section. "Data Readout Equipment and Possible Applications to Process Control," by A. St. Johnston.

ROCHESTER. — King's Head Hotel, High Street, 7 p.m. Incorporated Plant Engineers, Kent Branch. "The Plant Engineer and Work Study," by H. A. Gomm.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. Annual general meeting. "The B.B.C. Sound Broadcasting Service on Very-High Frequencies," by E. W. Hayes and H. Page.

SUTTON COLDFIELD.—Edgbaston Golf Club, 1 p.m. Birmingham Electric Club. Golf competition.

Thursday, 18th April

CHESTER.—Stafford Hotel, City Road, 7.15 p.m. Incorporated Plant Engineers, Merseyside and North Wales Branch. "Industrial Hydraulics," by D. V. Rowles.

DONCASTER. — Danum Hotel, 7.30 p.m. Institution of Works Managers, Doncaster Branch. Annual general meeting followed by a film, "Ideals in Industry."

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th April:—

HOTPOINT PRINCESS. No. 757,373. Class 7. Clothes-washing machines.—Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, London, W.C.2.

COLIBRI. No. 755,680. Class 9. Electric batteries and electric accumulators; and parts. —Colibri Lighters, Ltd., 69/70, Warren Street, London, W.1.

TEL. No. 756,892. Class 9. Electrically heated steam flat irons and electrically heated coffee percolators.—Brattel Electric Co., Ltd., Arcade House, 27, Old Bond Street, London, W.1.

AIRFLOW. No. 758,888. Class 9. Electric vacuum cleaners and electric floor polishing machines.—Vactric, Ltd., 35, Sunbeam Road, London, N.W.10.

SABA-RADIO. No. 759,563. Class 9. Radio apparatus and instruments and parts and fittings. — Saba Schwarzwälder Apparate-Bau-Anstalt August Schwer Söhne G.m.b.H., Villingen, Schwarzwald, Germany. Address for service, c/o Mathys & Squire, 52, Chancery Lane, London, W.C.2.

IGRASTAT. No. 760,589. Class 9. Electrical and electronic apparatus for use in the supervision of industrial apparatus and machinery, for automatically controlling the operation of such apparatus and machinery and for giving audible or visual warning of failures in their operation.—Igranic Electric Co., Ltd., Elstow Road, Bedford.

LABIX. No. 761,012. Class 9. Chassis (mountings) for electronic instruments.—Mullard, Ltd., Mullard House, Torrington Place, London, W.C.1.

PENTACOAT. No. 761,077. Class 9. Electric soldering irons.—Standard Telephones and Cables, Ltd., Connaught House, 63, Aldwych, London, W.C.2.

ACASYSTEM. No. 761,577. Class 9. Electrical and electronic apparatus for use in the supervision of industrial apparatus and machinery, for automatically controlling the operation of such apparatus and machinery and for giving audible or visual warning of failures in their operation.—Automation Consultants and Associates, Ltd., 18, Berkeley Street, London, W.1.

"Fifty Facts"

The Central Office of Information has issued a booklet entitled "50 Facts about Britain's Economy" which gives in compact form information upon population, industrialisation, the standard of living, industrial materials and power, exports, the balance of payments, development and a number of other facets of the country's life.

NEW PATENTS Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 17th April from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1951

30009. Standard Telephones & Cables, Ltd.—Electric coils. 7th November, 1952. (772528.)

1952

13363. Ward & Goldstone, Ltd., and Couyoumdjian, A. O.—Electric tumbler switches. 27th May, 1953. (772781.) 13365. Electric plug-and-socket couplings. 27th May, 1953. (772782.) 13368/9. Electric tumbler switches. 27th May, 1953. (772783/4.) 13370. Electric plug-and-socket couplings. 27th May, 1953. (772785.)

28621. Kurland, J. J., and Kurland, J. J. —Terminal structures for electrolytic condensers and other electrical devices. 13th November, 1952. (772653.)

1953

7418. Accumulatoren-Fabrik Akt.-Ges.—Alkaline accumulators. 17th March, 1953. (772594.)

13782. Electric & Musical Industries, Ltd.—Digital code information interchange systems. 17th May, 1954. (772714.) 13783. Apparatus for generating a series of related electrical signals especially for use in electrical code systems. 13th May, 1954. (772715.) 13784. Electrical code systems. 7th May, 1954. (772716.)

15680. Simplex Electric Co., Ltd.—Electric cooking stoves. 8th June, 1954. (772712.) 15681. Indicator devices for electric cooking stoves. 8th June, 1954. (772713.)

17115. Lewthwaite, R. W.—Circuit failure indicator systems. 17th September, 1954. (772655.)

24107. Tesla, Narodni Podnik.—Method of and a circuit for stabilising a valve amplifier by compensating for variations in the cathode emission. 1st September, 1953. (772953.)

24264. Igranic Electric Co., Ltd., and Taylor, J. R.—Control means for induction motors. 2nd September, 1954. (772596.)

24832. Standard Coil Products Co., Inc. —Frequency selectors for receiving individual frequencies in the u.h.f. bands. 8th September, 1953. (772839.)

27623. Electric & Musical Industries, Ltd. —Cathode structures for electron discharge devices. 8th October, 1954. (772597.)

33790. Pye, Ltd.—Trigger and counter circuits. 25th February, 1955. (772660.)

1954

3080. Hazeltine Corporation.—Colour television receiver. 2nd February, 1954. (772791.)

3596. Sharp, J. R., and Kaye, E.—Cases for electric storage batteries mounted on electrically propelled pallet or stillage trucks. 8th February, 1955. (772537.)

6156. British Telecommunications Research, Ltd.—Supervision of unattended repeater stations. 11th February, 1955. (772733.)

7028. Lindström, D. V. L., and Cronsten, A. G. G.—Tracing connections in switching networks. 10th March, 1954. (772735.)

11748. Electric & Musical Industries, Ltd. — Balance-to-unbalance transformers. 25th April, 1955. (772605.)

12354. Villiers, C. P. R. De.—Closed cycle thermal power plants. 6th December, 1954. (772891.)

12799. Pye, Ltd.—Television waveform generators. 20th April, 1955. (772607.)

14379. Beasant, R. J.—Secondary cells or storage batteries. 11th May, 1955. (772540.)

15064. Battelle Development Corporation. —Electrostatic image reproduction. 21st May, 1954. (772873.)

17492. Dowty Nucleonics, Ltd., formerly Davis, Wynn & Andrews, Ltd.—Charging devices for electroscopes. 6th June, 1955. (772494.)

17494. Electromagnets, Ltd.—Electromagnetic separating apparatus. 31st March, 1955. (772958.)

19256. Telefonaktiebolaget L. M. Ericsson.—Gas-filled electric-discharge tubes having a plurality of discharge gaps. 30th June, 1954. (772615.)

19431. English Electric Valve Co., Ltd.—Gas-filled discharge devices. 1st April, 1955. (772616.)

20360. Fenn, L. E.—Electric cigarette lighters and heating elements therefor. 12th July, 1954. (772671.)

20865. Philips Electrical Industries, Ltd. —Resistors having a positive temperature coefficient of resistance. 16th July, 1954. (772498.)

21913. Mullard Radio Valve Co., Ltd.—Circuits for television receivers and the like. 27th July, 1954. (772620.)

22694. Kabushikikaisha Nihondenshi Kogaku Kenkyusho.—Electron microscope. 4th August, 1954. (772621.)

23178. Signal-Stat Corporation.—Snap-action electric switches. 10th August, 1954. (772500.)

24536. Siemens-Schuckertwerke Akt.-Ges.—Dry rectifier assemblies. 23rd August, 1954. (772622.)

28114. General Electric Co.—Joining of wires by welding and soldering and the like. 29th September, 1954. (772756.)

34060. International Business Machines Corporation.—Electronic integrator. 24th November, 1954. (772509.)

34727. Veb Funkwerk Kopenick.—Thermionic valve relays. 30th November, 1954. (772547.)

35316. Siemens-Schuckertwerke Akt.-Ges.—Processes for the protection of dry rectifier elements. 6th December, 1954. (772514.)

36052. Siemens & Halske Akt.-Ges.—Matching systems for wave guides. 13th December, 1954. (772631.)

36229. Soc. l'Air Liquide, Soc. Anon. pour l'Étude et l'Exploitation des Procedes G. Claude.—Arc voltage regulating circuits in consumable electrode welding. 14th December, 1954. (772896.)

37699. British Relay Wireless, Ltd.—Connections to electrical cables. 18th November, 1955. (772549.)

37781. Scarborough Associates, Inc.—Electric incandescent lamps. 31st December, 1954. (772550.)

1955

547. Heidecke, R., and Franke, H.—Electrical plug and socket flash-lamp connectors. 7th January, 1955. (772854.)

624. Telefonaktiebolaget L. M. Ericsson.—Devices for remote indication of the condition of a multiplicity of elements. 7th January, 1955. (772897.)

5874. Svenska Turbinfabriks Aktiebolaget Ljungström.—Contra rotation radial flow turbine for the driving of electric generators. 28th February, 1955. (772688.)

6654. General Electric Co.—Organo-silicon compounds. 7th March, 1955. (772768.)

6929. Philips Electrical Industries, Ltd.—Glow-discharge tubes. 9th March, 1955. (772523.)

7133. Lemouzy, J. A.—Probe units for electronic measuring devices. 10th March, 1955. (772524.)

7662. Philips Electrical Industries, Ltd.—Manufacture of silicon carbide crystals. 16th March, 1955. (772691.)

9141. Philips Electrical Industries, Ltd.—Circuit arrangements comprising gas and/or vapour filled electric-discharge tubes. 29th March, 1955. (772525.)

9172. Wells & Co., Ltd., A., and Wells, A. W. J.—Electric motors. 30th December, 1955. (772882.)

9282. Soc. d'Etudes Eléctro-Mecaniques. —Thermo-responsive bimetallic element. 30th March, 1955. (772526.)

10469. Philips Electrical Industries, Ltd. —Electrolytic capacitors. 12th April, 1955. (772555.) 10926. Electric capacitors. 15th April, 1955. (772557.)

11066. Erie Resistor Corporation.—Voltage divider. 18th April, 1955. (772558.)

11300. General Electric Co.—Magnetic amplifiers. 19th April, 1955. (772559.)

11321. Sylvania Electric Products, Inc.—Electrode assemblies for electron-discharge tubes. 19th April, 1955. (772560.)

11439. Westinghouse Air Brake Co.—Timing means employing relays for counting cycles of a.c. 20th April, 1955. (772561.)

12808. Licentia Patent-Verwaltungs-Ges. —Protective device for mechanical current convertors. 3rd May, 1955. (772641.)

12839. General Electric Co.—Electric vacuum cleaners. 3rd May, 1955. (772796.)

14771. Naamlooze Vennootschap Nederlandsche Industrie Radio Artikelen, Nira.—Electric calling systems. 23rd May, 1955. (772571.)

14781. Westinghouse Electric International Co.—X-ray image transformers. 23rd May, 1955. (772572.)

16000. Philco Corporation.—Colour television receivers. 3rd June, 1955. (772575.)

16207. General Electric Co.—Light detection apparatus. 6th June, 1955. (773006.)

16673. United Kingdom Atomic Energy Authority.—Fuel element charging/discharging gear for nuclear reactors. 4th June, 1956. (772702.)

17342. Standard Telephones & Cables, Ltd.—Electrical multiple contact-making devices. 16th June, 1955. (773012.)

17738. Standard Telephones & Cables, Ltd.—Electrical apparatus mounting arrangements. 20th June, 1955. (773015.)

18648. Philips Electrical Industries, Ltd. —Semi-conductor devices. 28th June, 1955. (772583.)

19485. Soc. Technique pour l'Industrie Nouvelle Soc. Anon. Stin.—Contact arrangements for electric switches. 6th July, 1955. (772705.)

19726. Bendix Aviation Corporation.—Bi-directional transformer coupled deflection circuit. 7th July, 1955. (772584.)

19887. Soc. Anon. Française du Ferodo. —Electromagnetic clutches. 8th July, 1955. (773018.)

21969. Brown, Boveri & Co., Ltd.—Nuclear reactor elements. 29th July, 1955. (773021.)

22019. General Electric Co.—Manufacture of insulating panels. 29th July, 1955. (772972.)

22176. Parvex.—Ventilation of rotary electric machines. 2nd August, 1955. (772973.)

25611. Textron American, Inc.—Electromagnetic vibrator. 7th September, 1955. (772930.)

25848. Standard Telephones & Cables, Ltd.—Tunable magnetron. 9th September, 1955. (772992.)

26138. Standard Telephones & Cables, Ltd.—Local loop connectors to trunk telegraph circuits. 13th September, 1955. (773030.)

26174. Soc. Anon. de Machines Electrostatiques.—Regulation and excitation system for electrostatic generators. 13th September, 1955. (773031.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—State Electricity Commission of Victoria, Melbourne. 17th April. 21,000 disc insulators. (E.S.B. 8540/57. Ten/25084.)*

State Electricity Commission of N.S.W., Sydney. 29th April. Remote supervisory and control apparatus. (E.S.B. 8172/57. Ten/25063.)*

Electricity Trust of South Australia, Adelaide. 30th April. Capacitors. (E.S.B. 8539/57. Ten/25107.)*

State Contracts Control Board, Sydney. 15th May. Electric stereo metal pots. (E.S.B. 8362/57. Ten/25129.)*

Burma.—Union of Burma Purchase Board, Rangoon. 18th April. Telephone wire. (E.S.B. 8336/57. Ten/25142.)*

Director General, Industrial Development Corporation. 15th May. Diesel power plant. (E.S.B. 8554/57. Ten/25124.)*

Canada.—Manitoba Hydro-Electric Board, Winnipeg. 23rd April. Boiler feed pump units. (E.S.B. 8876/57. Ten/25200.)*

Durham.—County Council. Electrical installations in Durham New Technical College, Heworth New Modern School, Felling, and Jarrow Grammar School. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Electrical services at Lairg, Glen Moriston and Dundreggan Dam power stations. (See this issue.)

Formosa.—Central Trust of China, Taipei. 17th April. Control cable. (E.S.B. 8503/57. Ten/25085.)* 600 V control cable. (E.S.B. 8770/57.I.C.A. Ten/25159.)* 7th May. Voltage stabiliser, electric oven, etc. (E.SB. 8501/57. Ten/25096.)*

India.—Madras Electricity Department. 17th April. H.v. and l.v. cables. (E.S.B. 8181/57. Ten/25035.)*

Stores Purchasing Committee, Bangalore. 22nd April. 5 kV switchgear. (E.S.B. 8182/57. Ten/25093.)* 3rd May. Two 2,500 kVA, two 10,000 kVA and two 15,000 kVA transformers. (E.S.B. 8184/57. Ten/25044.)* 11 kV switchgear. (E.S.B. 8188/57. Ten/25038.)* 110 kV transmission line towers, conductors, insulators and accessories. (E.S.B. 8186/57. Ten/25045.)* Transformers. (E.S.B. 8185/57. Ten/25049.)* Circuit-breakers, lightning arrestors and disconnecting switches. (E.S.B. 8187/57. Ten/25051.)*

Director General of Supplies and Disposals, New Delhi. 23rd April. Eight electrically driven centrifugal pumps. (E.S.B. 8169/57. Ten/25109.)*

Damodar Valley Corporation. 13th May. Cables and joint boxes. (See this issue.)

Control panels for Panchet Hill power station and extensions to Maithon and Jamshedpur substations. (See this issue.)

Iraq.—Directorate General of Posts and Telegraphs. 10th May. V.h.f. radio links. (E.S.B. 8241/57. Ten/25116.)*

Development Board and Ministry of Development. 17th June. Steam generators and auxiliary equipment for Basrah power project. (E.S.B. 8392/57. Ten/25147.)*

Kiveton Park.—R.D.C. 2nd May. Electrical installations in 23 houses at North Anston. W. M. Gibson, surveyor, 78, Lidgett Lane, Dinnington, Rotherham.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

New Zealand.—General Post Office, Wellington. 6th May. Resistors. (E.S.B. 8288/57. Ten/25157.)* 8th May. Telephone cable. (E.S.B. 8382/57. Ten/25104.)* 9th May. P.v.c. covered wire. (E.S.B. 8351/57. Ten/25074.)* 10th May. Cadmium-copper tapes. (E.S.B. 8352/57. Ten/25092.)* 15th May. Insulator spindles. (E.S.B. 8383/57. Ten/25091.)* 17th May. Insulator spindles. (E.S.B. 8354/57. Ten/25089.)*

Portuguese East Africa.—Ports, Railways and Transport Department, Lourenço Marques. 3rd June. 20 kVA generating sets. (E.S.B. 7920/57. Ten/25059.)*

South Africa.—Union Tender and Supplies Board, Pretoria. 25th April. Electric cables and wires. (E.S.B. 8259/57. Ten/25072.)* 16th May. Electric welding outfits. (E.S.B. 8608/57. Ten/25158.)*

Stores Department, South African Railways, Johannesburg. 18th April. Train lighting batteries. (E.S.B. 7558/57. Ten/25162.)*

Tangier.—La Régie des Services de l'Eau et d'Electricité. 10th May. Construction and electrification of 5,500 V h.v. line. (E.S.B. 7887/57. Ten/25117.)*

ORDERS PLACED

Huntingdon.—East Anglian Regional Hospital Board. Rewiring the electrical installation at the County Hospital, Huntingdon (£8,126).—Mann, Egerton & Co.

Oxford.—Housing Committee. Recommended. Improving the electrical installations in 292 houses on the Donnington, Iffley Road and Meadow Lane estates (£7,060).—Lindars Electrical Contractors (Oxford).

Southampton. — Education Committee. Renewal of the electrical installation at the Ascupart Primary School (£2,525).—F. H. Wheeler (Southern).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Factory extensions; Kapok, Ltd., North Acton Road, London, N.W.10.

Alfreton.—Factory; Alfreton Knitting Mills, Ltd., Rowland Street.

Basildon.—Works; Ilford, Ltd., Bower House, Havering-atte-Bower, Romford.

Bedford.—Central kitchen, staff dining room, recreation hall and extensions to male staff hostel at Bromham Hospital (£74,200); regional architect, North West Metropolitan Regional Hospital Board, Sheffield House, Sheffield Street, London, W.C.2.

Belfast.—Factory extension, Castlereagh estate; Sir Isaac Pitman & Sons, Ltd., Alanbrooke Road.

Crawley.—Hazelwick North Secondary School (£134,600) and second instalment of North Sussex College (£349,626); Woodroffe Buchanan and Coulter, architects to West Sussex E.C., 5, Bedford Row, W.C.1.

Darlington.—Additions to Queen Elizabeth Hospital; E. A. Tornbohm, borough architect, Central Buildings.

Factory (£10,000), Aycliffe, for Teesside Farmers, Ltd., Darlington.

Doncaster.—Eight-storey hospital, Armthorpe Road; Sheffield Regional Hospital Board, Fulwood House, Old Fulwood Road, Sheffield, 10.

Ellesmere Port.—Grammar school, Chester Road (£200,000); J. G. Kellett, director of education, City Road, Chester.

Gosforth (Northumberland).—New premises for the Gosforth and Coxlodge British Legion Club (£19,000); C. Emmerson, Ltd., builders, Salters Road, Gosforth.

Hartlepool.—Library (£7,000) and community centre (£18,000), Miers Avenue; J. Wilkin, borough engineer.

Lincoln.—Omnibus station and head offices, St. Mark's Square, for the Lincolnshire Road Car Co., Ltd.; Tilling Association, Ltd., 10, Fleet Street, London, E.C.4.

London.—Eight-storey wing to Crosby Hall, Cheyne Place, Chelsea; Carden & Godfrey, architects, 120, Chancery Lane, W.C.2.

Office block, High Holborn; Trehearne & Norman, Preston & Partners, architects, 83, Kingsway, W.C.2.

Flats (36), Hall Park area; borough housing architect, Paddington.

Maltby.—Group training centre for mentally handicapped children, Addison Road; surveyor, Urban Council Offices, Rotherham Road, Maltby, near Rotherham.

North Riding.—Additions to Whitby Grammar School (£45,000) and Joseph Rowntree School (£47,000), and erection of school at Nunthorpe (£108,000); county school architect, Northallerton.

Nottingham.—Science block for University Agricultural Department: Basil Spence & Partners, architects, 48, Queen Anne Street, London, W.1.

Prescot.—Houses (62), Bretherton Road area, and maisonnettes (24), Ackers Street; Gornall, Kelly & Partners, architects to U.D.C., 155, The Albany, Old Hall Street, Liverpool, 3.

Rugby.—Further extensions to College of Technology and Arts; county architect, Warwick.

Sunderland.—Congregational church at Grindon (£10,000); S. Pace, builder, Kings Road.

Houses (50) for R. L. S. Pemberton; G. T. Brown & Son, architects, 53, Fawcett Street.

Swansea.—Central clinic and ambulance depot, Orchard Street/Pleasant Street site (£156,000); borough engineer, Guildhall.

Tynemouth.—Two-storey premises in Bedford Street for J. Hart; G. H. Gray & Partners, architects, Camden Street, North Shields.

Three-storey blocks of flats and maisonnettes, John Street, Cullercoats; borough engineer, 16, Northumberland Square, North Shields.

Watford.—New 91-bedroom hostel proposed for Y.M.C.A.; secretary, Watford Branch, Clarendon Road.

Welwyn Garden City.—Extensions for Nabisco Foods, Ltd. (£400,000); Welwyn Builders, Ltd., Bridge Road.

West Bromwich.—Factory, offices and canteen, Birmingham Road, for Webley & Scott; Peacock & Bewlay, architects, 224, Hagley Road, Edgbaston, Birmingham, 15.

West Hartlepool.—Additions to girls' high school (£57,000); John Proud, Ltd., builders, York Road.

Weymouth and Melcombe Regis.—Theatre and dance hall, old Ritz Theatre site; borough engineer, 6, Pulteney Buildings, Weymouth.

Windsor.—Factory, Vale Road; Pantak, Ltd., industrial X-ray, 72-76, Alpha Street, Slough.

Wingerworth (Chesterfield).—Agricultural machinery depot, showrooms, petrol filling station, etc., Derby Road; W. Chapman, Dobson & Partners, town planning consultants, Pear Tree House, Jordangate, Macclesfield.

Worksop.—Village hall at Holbeck; Brierley, Syme & Leckenby, architects, 10, Lendal, York.